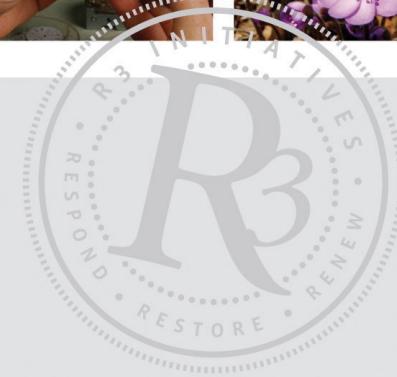


RESPOND RESTORE RENEW



# Colleague®

*Technical  
formation*



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# Welcome to Colleague Technical Training.



The following slides are used for technical training purposes and should be used in conjunction with the current service manual.



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# Welcome to Colleague Technical Training.



# Nigel Atkinson.





## Colleague 1 & 3 Technical Course

- **At the completion of this Technical Training course, you will be:-**
  - Able to demonstrate a working knowledge of the Colleague as described in the Service Manual,
  - Familiar with the Mechanical, Electrical and Operational features
  - Able to perform Disassembly, Re-assembly tasks and Repairs to sub assembly level.
  - Able to perform Testing, Preventative Maintenance and Troubleshooting Routines as described in the Service Manual.





# Training Course Format

## Logistics

- Registration
- Breaks
- Comfort Stops
- Lunch/Dinner
- Parking
- Introductions

## Course objectives

- At the completion of this Technical Training course, you will be expected to pass with at least 80% in an open book test

## Learning format

- Show Tell
- See & Do
- Q & A - FAQ's
- Testing
- Course evaluation feedback



# Agenda Day 1

- Introductions
- Infusion Systems
- Colleague Volumetric Infusion Pump
  - Video: "A look Inside"
- Colleague 1 & 3 Overview
  - Features and Controls
- Powering Up the pump, Pump Operation.
- The Menu Tree
  - Pump Personalities
  - Pump History
- The Shuttle Mechanism
  - Overview
  - Practical Session - Dismantle and review PHM
- Troubleshooting a failure
- Free discussion FAQ's





## Agenda Day 2

- Day 1 review
- Personalities
  - Personality data transfer
  - Event History Download
- Colleague Upgrades
  - Battery harness
  - Keypad Harness Insulator
  - Power Supply
  - PHM Resin Joints
- Pump strip-down
  - PHM, UIM, PSU
  - Re-build, test & calibration
- Configuration and Service Screens
  - Preventive Maintenance
  - Repair Test & Inspection
  - Keypad Insulator Installation
  - Calibration
- Review of Day 2
- Course test

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# Welcome to **Colleague Technical Training.**



## **Introductions.**

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# Australian Product Support



• Call 1800 063 093

• Spare parts :

Marco, Noelene

**Baxter**



## Device Description

- The Baxter Colleague Volumetric Infusion pump is designed to accurately control and monitor the flow of solutions to the patient.
- The device is rated for high risk & neonatal use.
- It is suitable for :
  - General Drug Administration
  - Epidural Procedures
  - Blood Transfusions
  - Chemotherapy
  - TPN (Total Parenteral Nutrition)



## An Infusion System

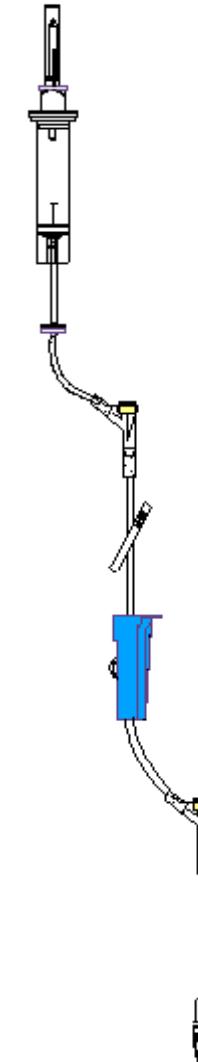
- An infusion system is usually made up of:
  - A solution required to be delivered to a patient:
    - Saline solution to balance patients fluids
    - Saline solution together with added drugs such as antibiotics
    - Nutritional products
    - Solution may be either from a fluid bag, bottle or a syringe or similar container.
  - A line connecting the container to the patient, often described as 'a giving set' or 'administration set'.
    - Sets come in different forms with different elements as part of the set, such as:
      - Special particle filters
      - Injection ports
      - Burette containers
  - A needle or needless system to make the connection to the patients vein or entry site.
  - A pump to control the flow of the solution to the patient over time.





## The Administration Set

- The basic administration set used in the Colleague Pump is the standard PVC set incorporating:
  - A spike ( to open the container )
  - A drip chamber with filter ( to view the drips )
  - A blue safety slide clamp ( a secondary patient safety device )
  - A roller clamp ( for controlling the flow when running on gravity )
  - An injection port (for admin. of drugs )
  - A Luer lock connection ( for connection to a venflon / needle)
- The blue safety clamp closes automatically when the set is removed from the pump. This clamp is unique to Baxter devices and must be in place before the device will operate.
- It is keyed so it will only insert in the correct direction.





## Infusion Parameters

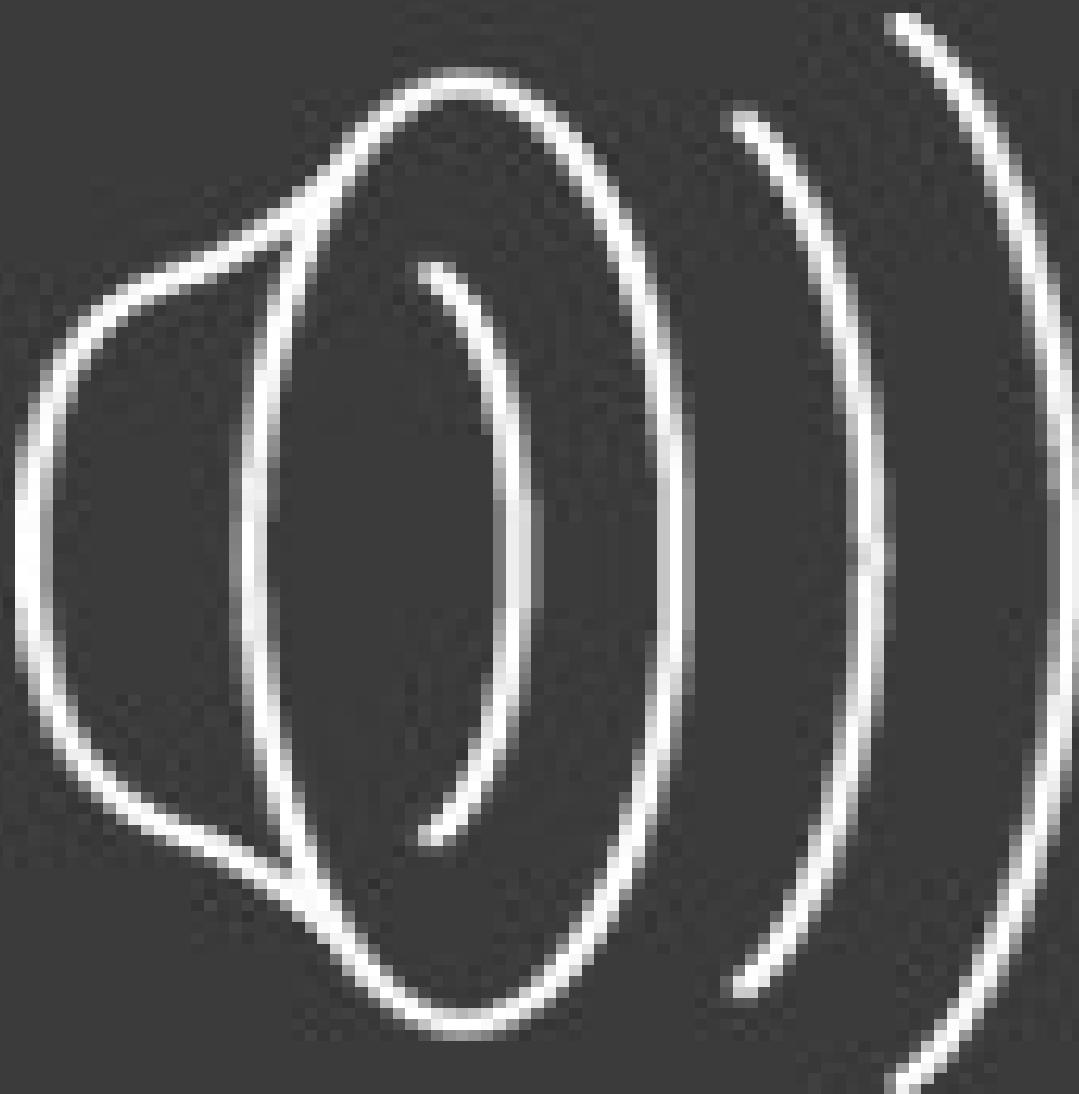
- The key parameters for an infusion:
  - The Volume of solution to be delivered to the patient.
  - The Rate of delivery.
- In the simplest form these are given in Millilitres (ml) and Millilitres per hour (ml/hr), but may be prescribed and programmed differently into the pump.
- The volume and rate are keyed into the pump and the pump is started.
- Under normal circumstances the infusion will start and run for the duration of the infusion.
  - For example: Volume = 1000ml, Rate = 125ml/hr
  - The infusion will run for 8 hours.
  - MOVIE

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## Colleague Movie

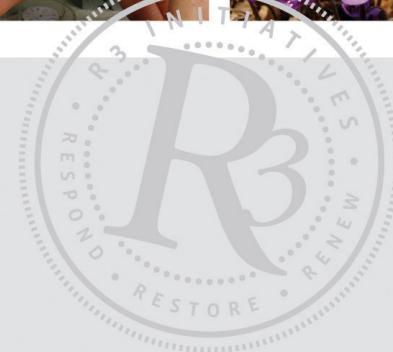
**Baxter**





## Movie Quiz??

1. What kind of sets are used in the Colleague infusion Pump?
2. What is the core technology in the Colleague?
3. What is the basis of the Shuttle?
4. How many parts are 1ml of fluid resolved into?
5. What is unique about the loading of the administration set?
6. What safety feature exists on all Colleague admin. sets?
7. How many displays are there on Colleague?
8. What are they?
  
9. What is the purpose of Pump Personalities?
10. How many events are recorded in Event History?



1. What kind of sets are used in the Colleague infusion Pump?
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9. What is the purpose of Pump Personalities?
10. How many events are recorded in Event History?

1. Standard gravity set
2. The Shuttle
3. Two V blocks
4. 3,414 parts
  
5. It is automatic
6. The blue 'ON/OFF' safety clamp
7. Two
8. Large graphic & Vacuum fluorescent
  
9. Means of customizing the pump
10. Up to 1000 events



## PUMP HEAD MECHANISM

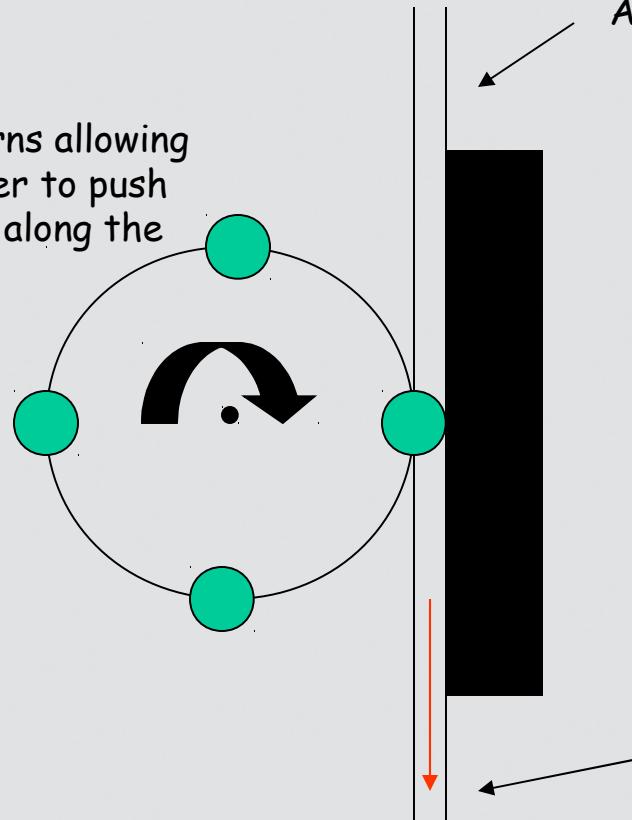
**Why the Shuttle?**

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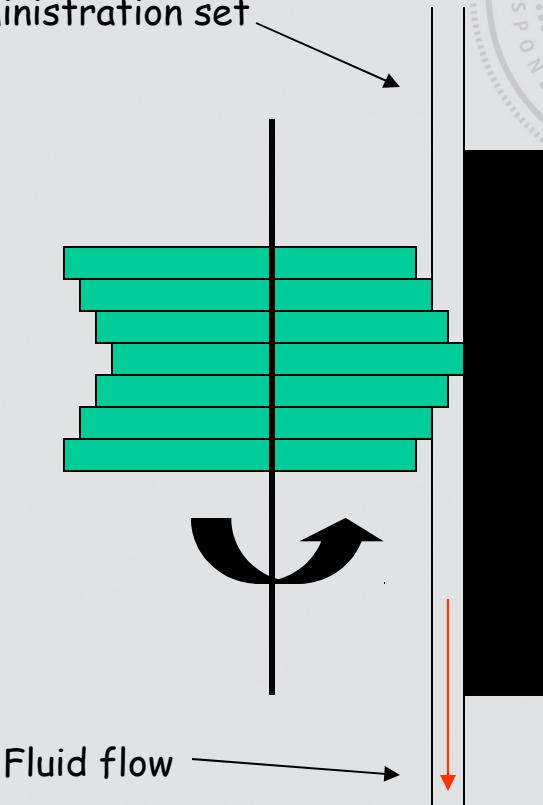
## Rotary & Linear Peristaltic Mechanisms

Rotor turns allowing each roller to push the fluid along the tubing



Rotary Mechanism

Administration set



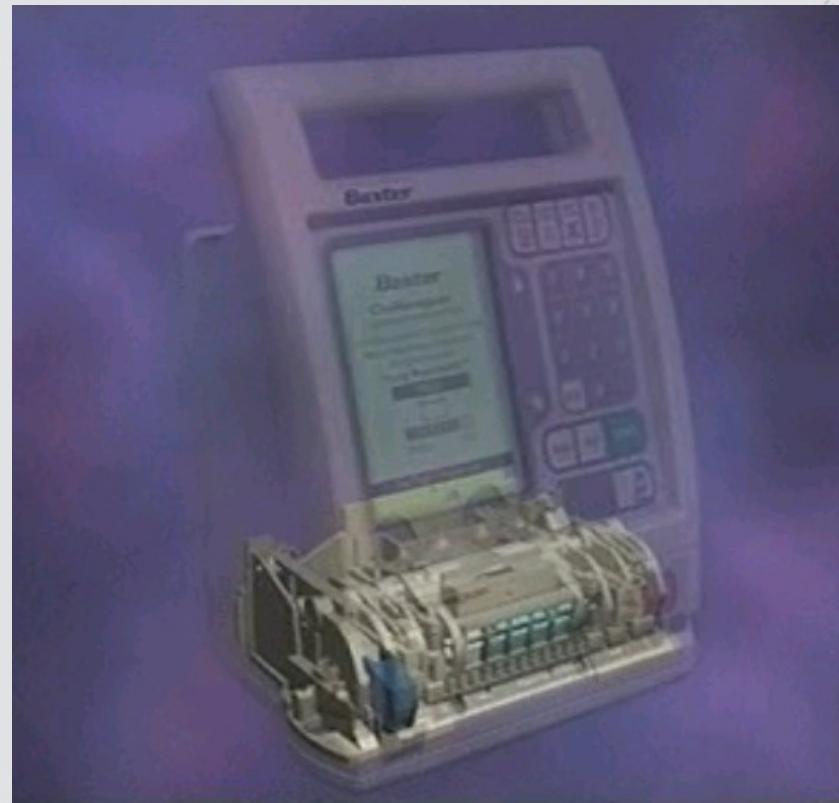
Linear Mechanism **Baxter**

Fingers move sequentially massaging the tubing

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# Colleague Shuttle Action

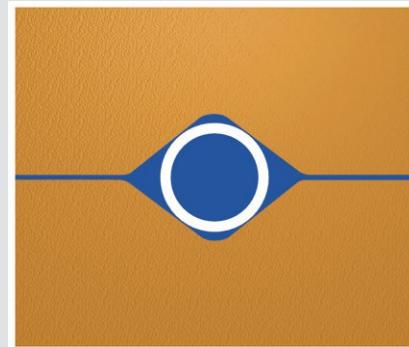


**Baxter**

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## The Shuttle Mechanism

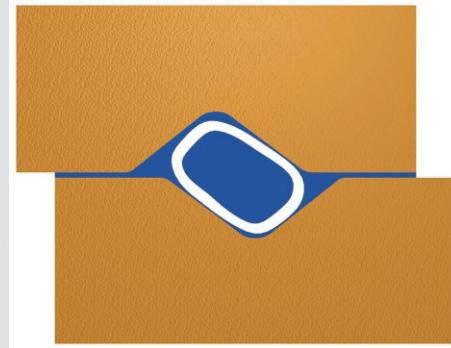


**Baxter**

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## The Shuttle Mechanism

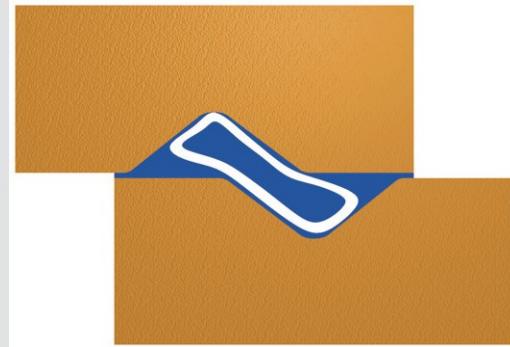


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## The Shuttle Mechanism

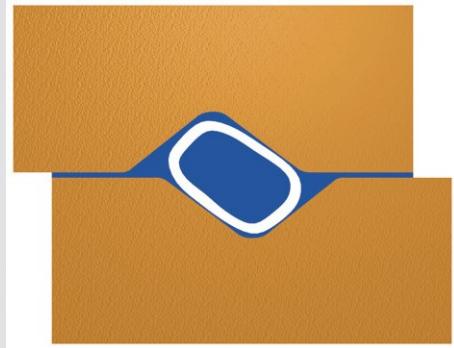


**Baxter**

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## The Shuttle Mechanism

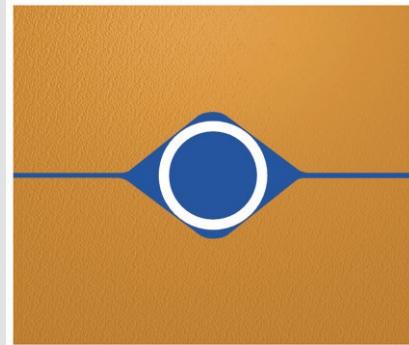


**Baxter**

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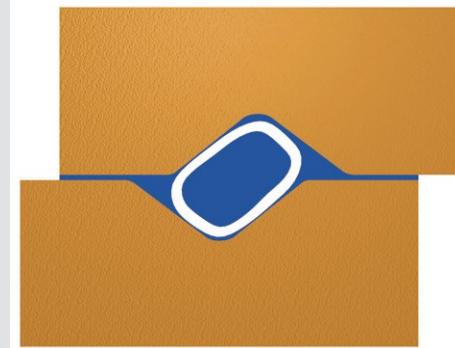


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## The Shuttle Mechanism

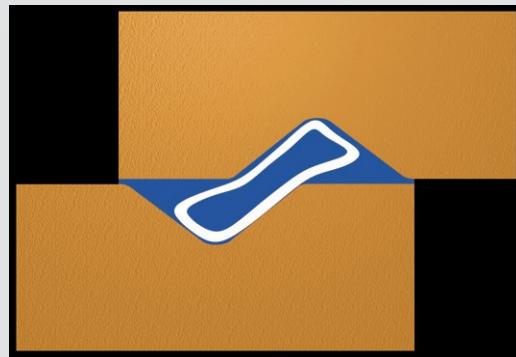


**Baxter**

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## The Shuttle Mechanism

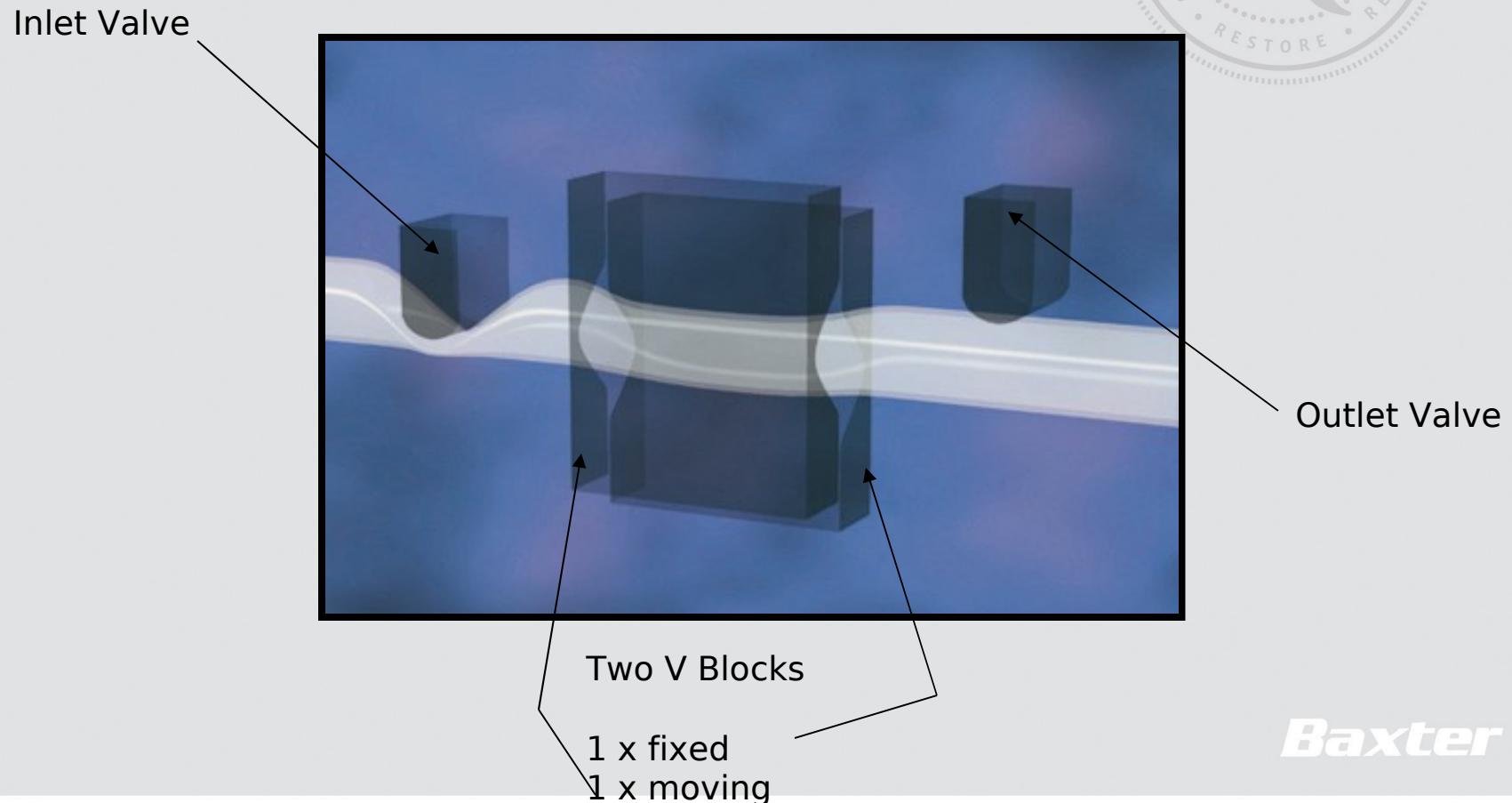


**Baxter**  
STOP

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## The Shuttle Mechanism

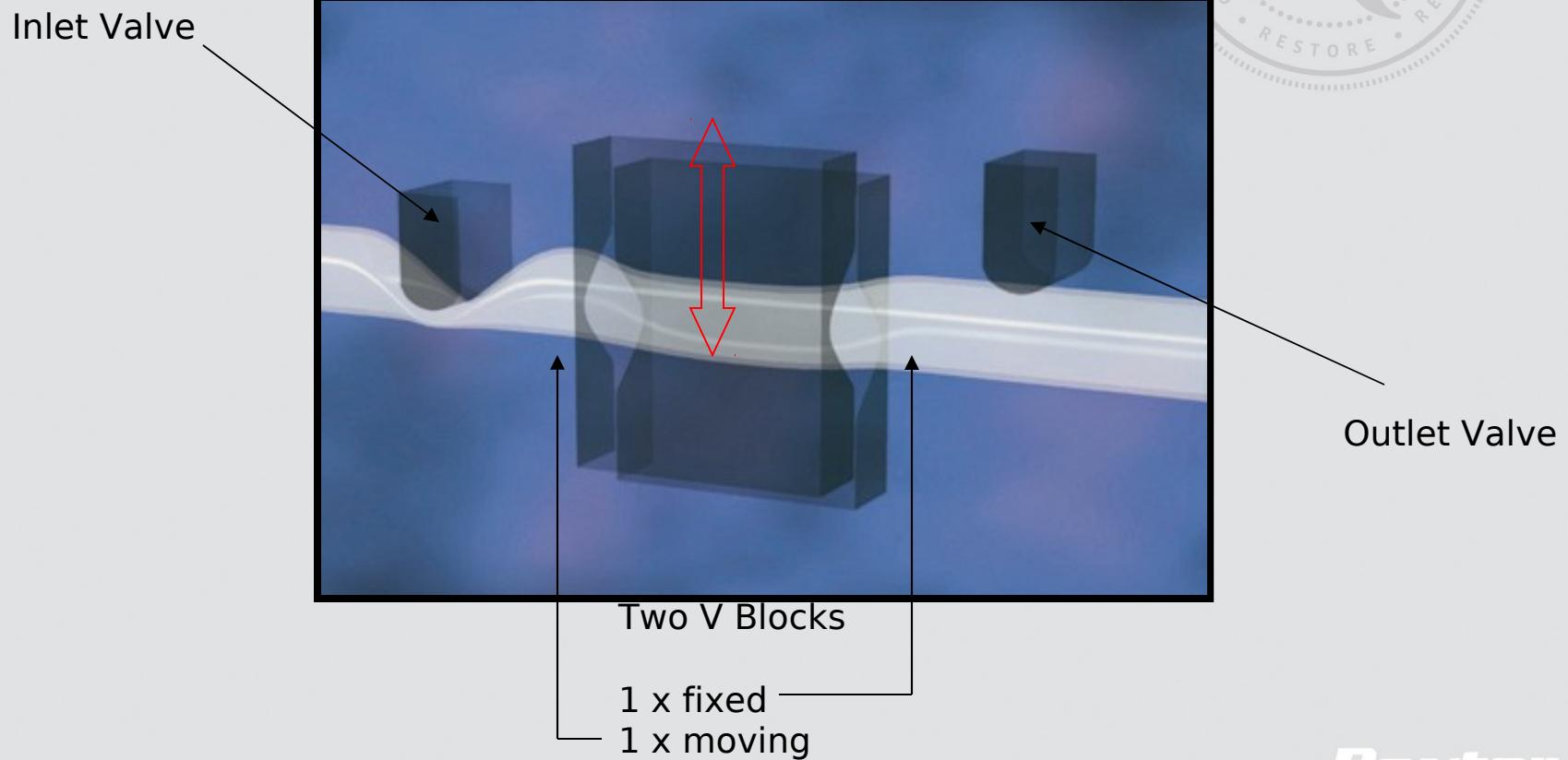


**Baxter**

RESPOND RESTORE RENEW



## The Shuttle Mechanism

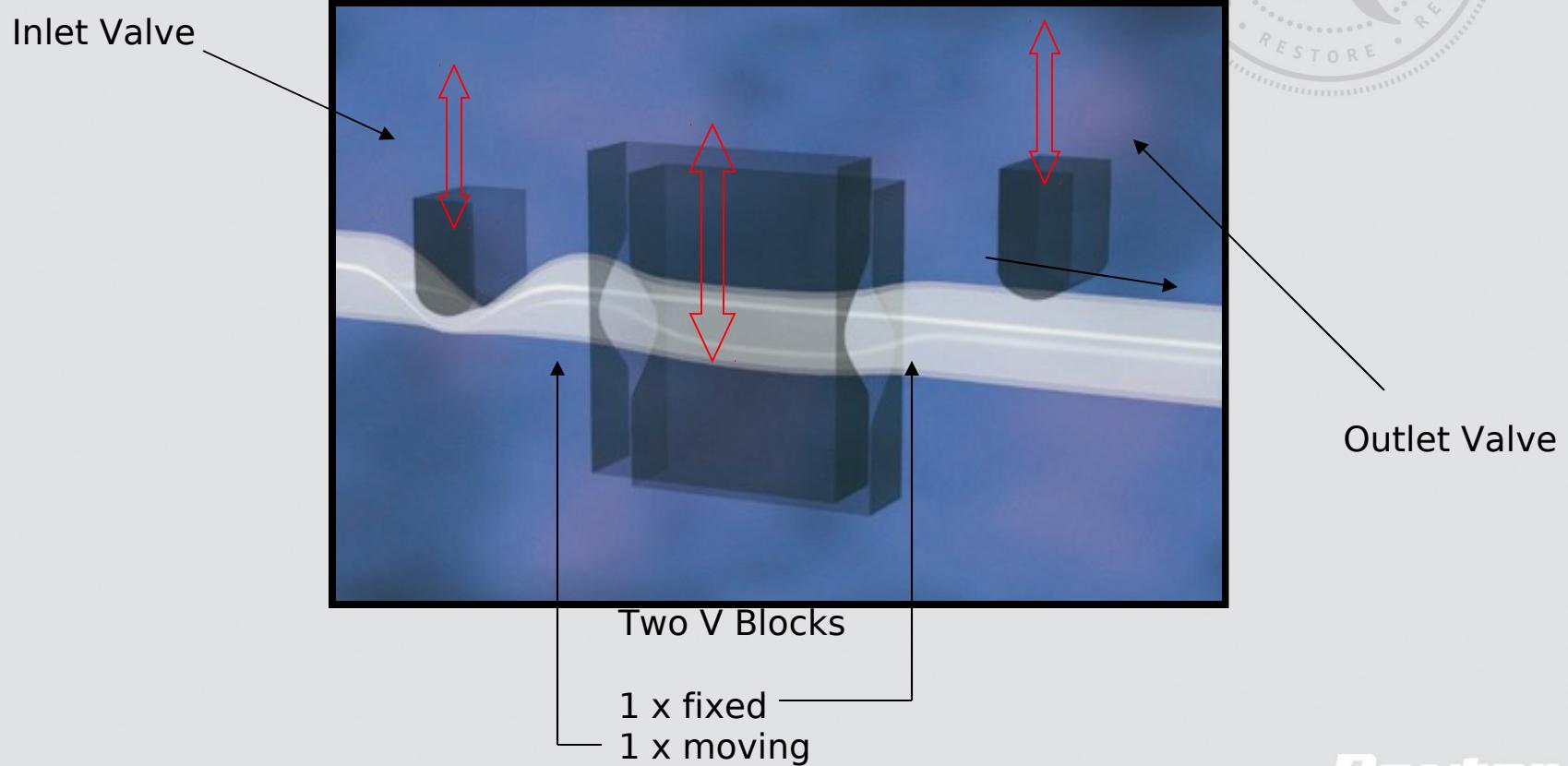


**Baxter**

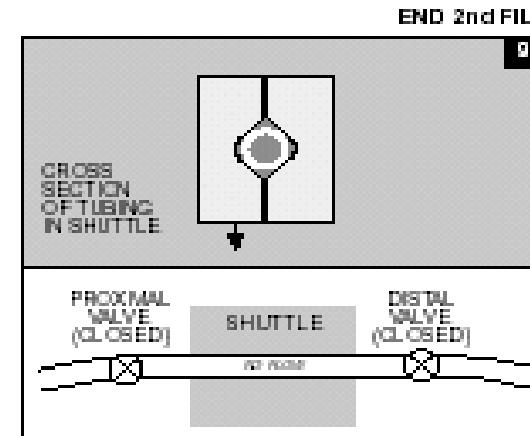
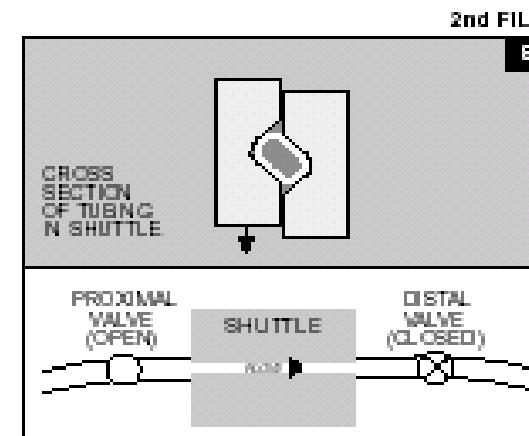
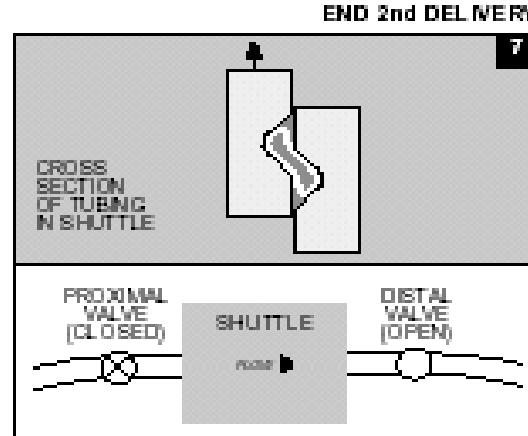
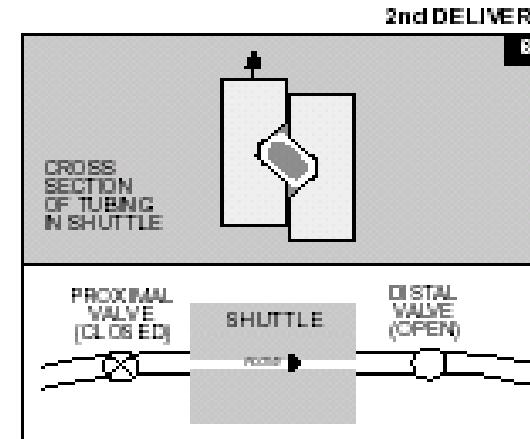
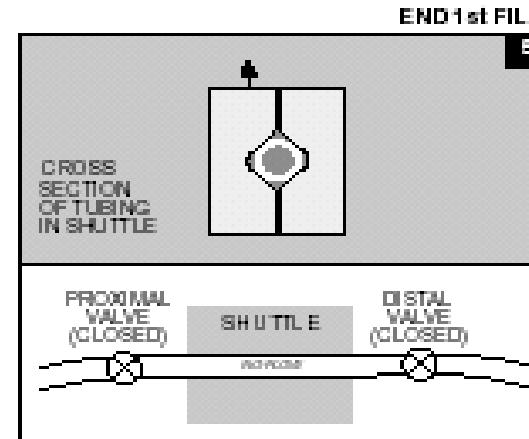
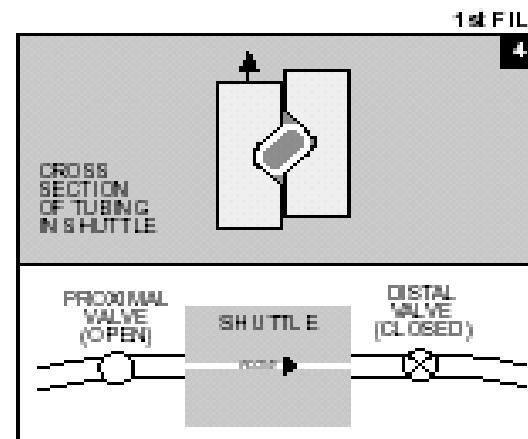
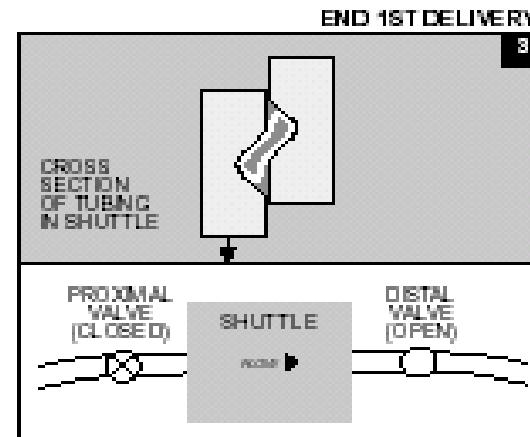
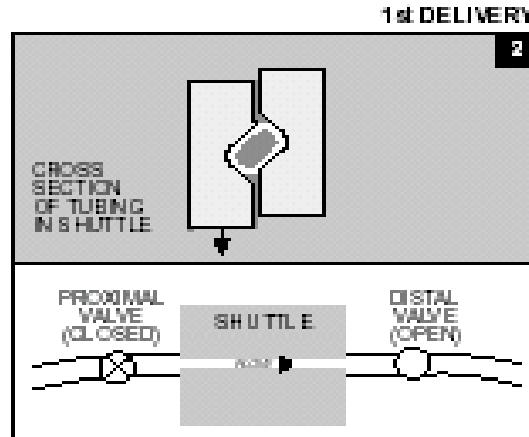
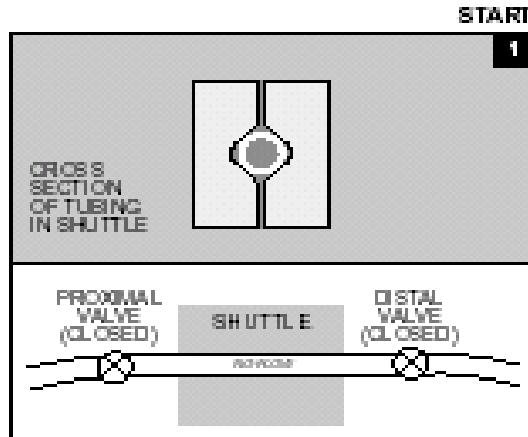
RESPOND RESTORE RENEW



## The Shuttle Mechanism



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# Colleague® Technical Information Shuttle Technology

- **Benefits:**

**Maintain accurate delivery over 72 Hrs**

- Micro-Macro Flow Rates (0.1ml/Hr-1200ml/Hr)
- Uses inexpensive pump compatible gravity giving sets.

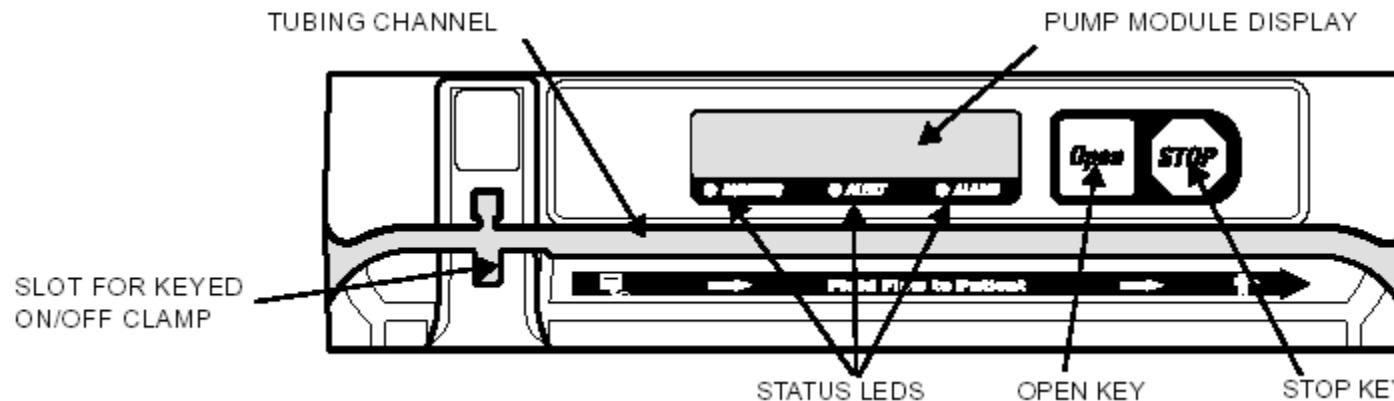
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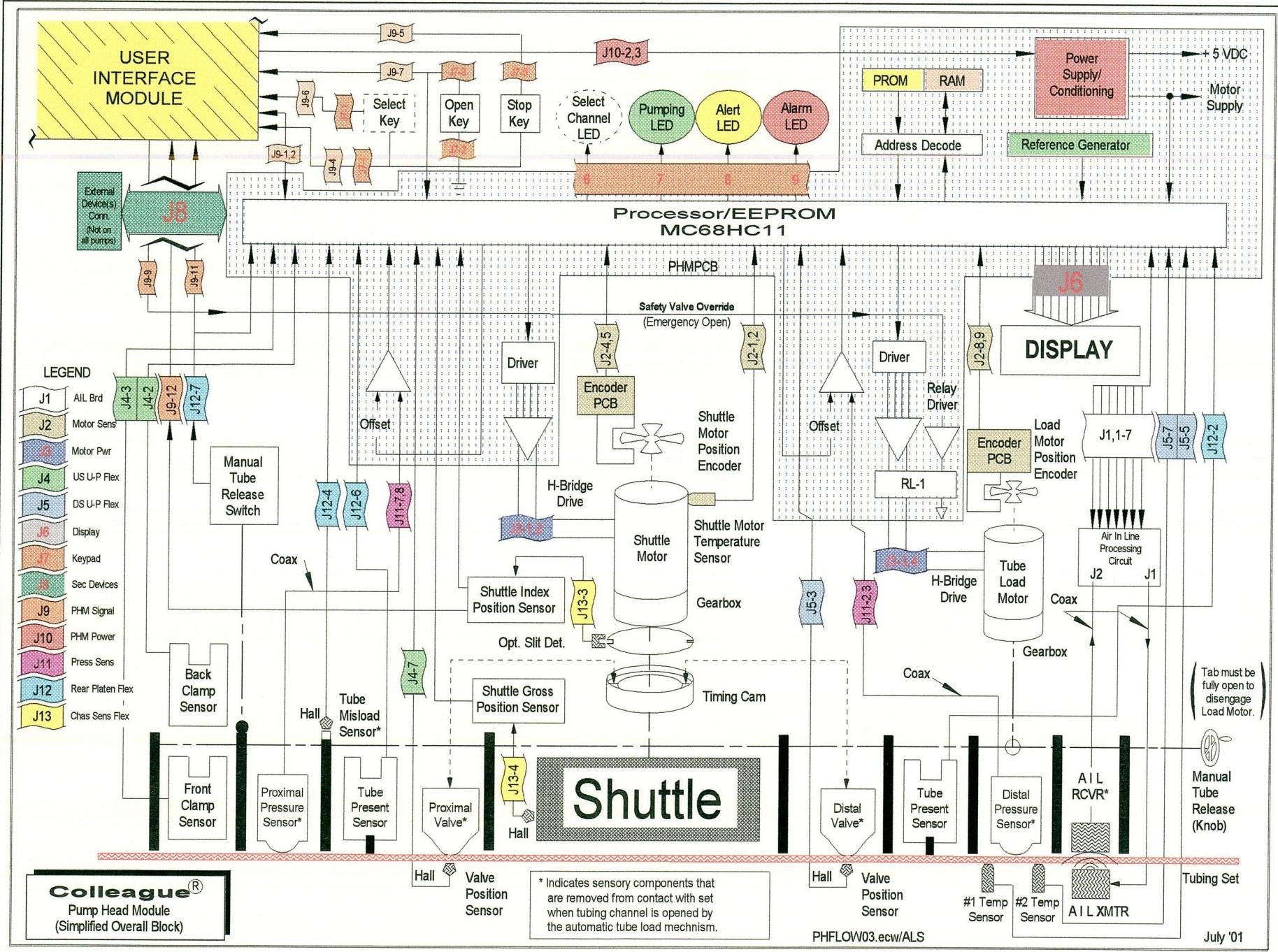
## The Pump Head Module (PHM)

### Pump Module

The Pump Module is located below the Main Body.



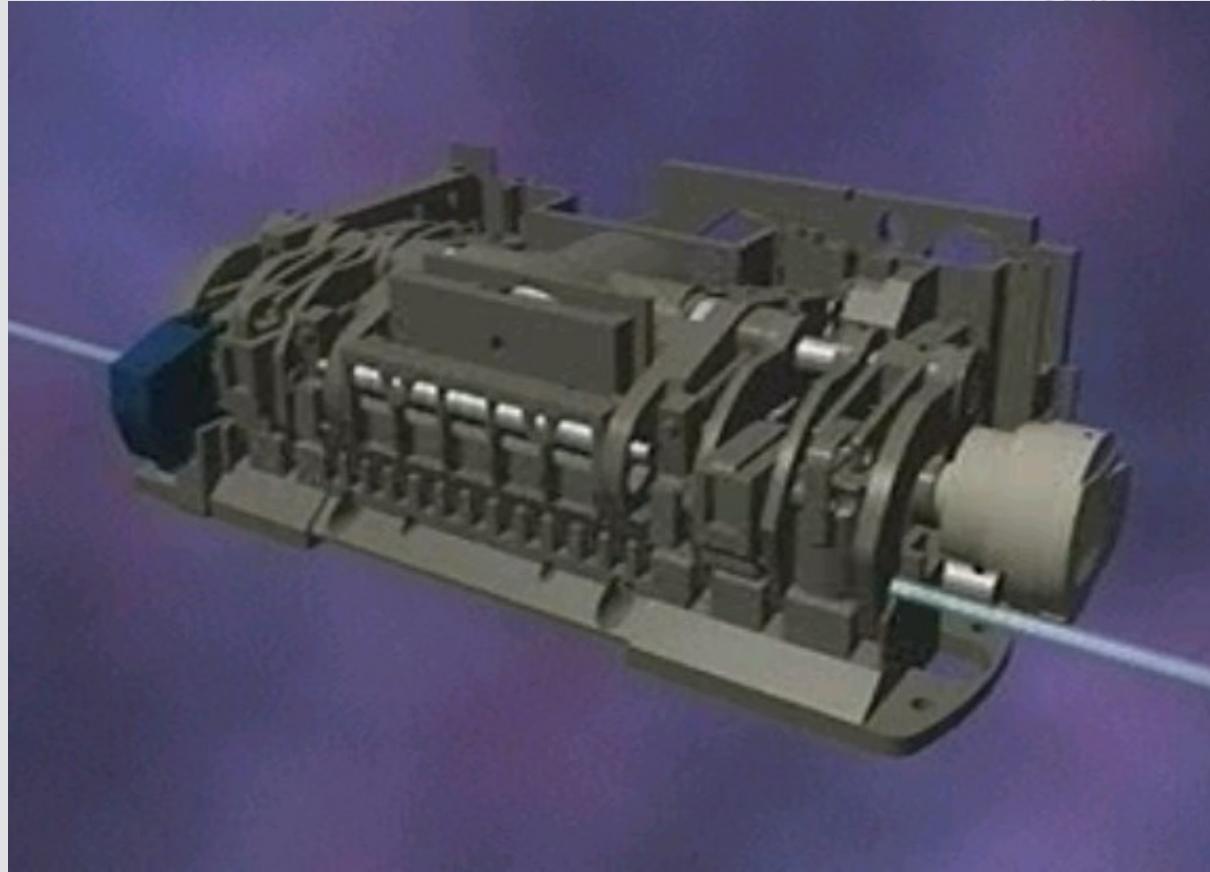
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## PUMP HEAD MECHANISM



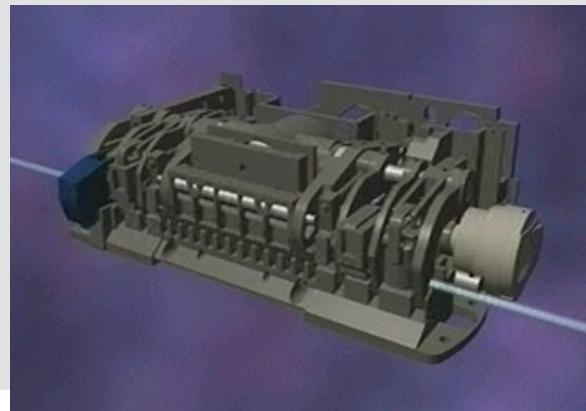
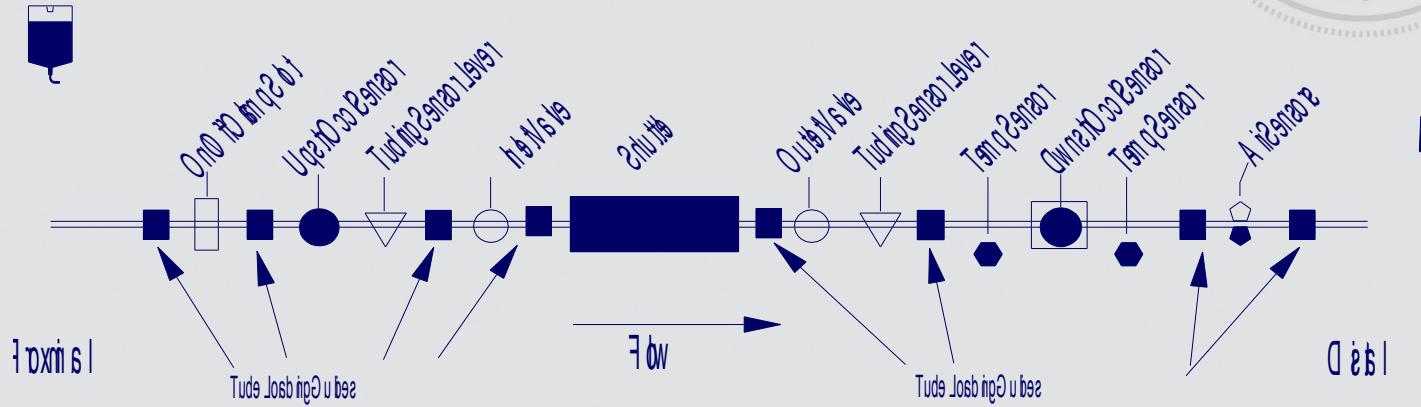
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## PUMP HEAD MECHANISM



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## PUMP HEAD MECHANISM

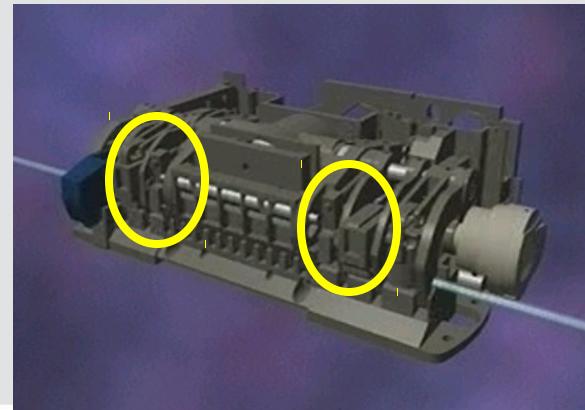
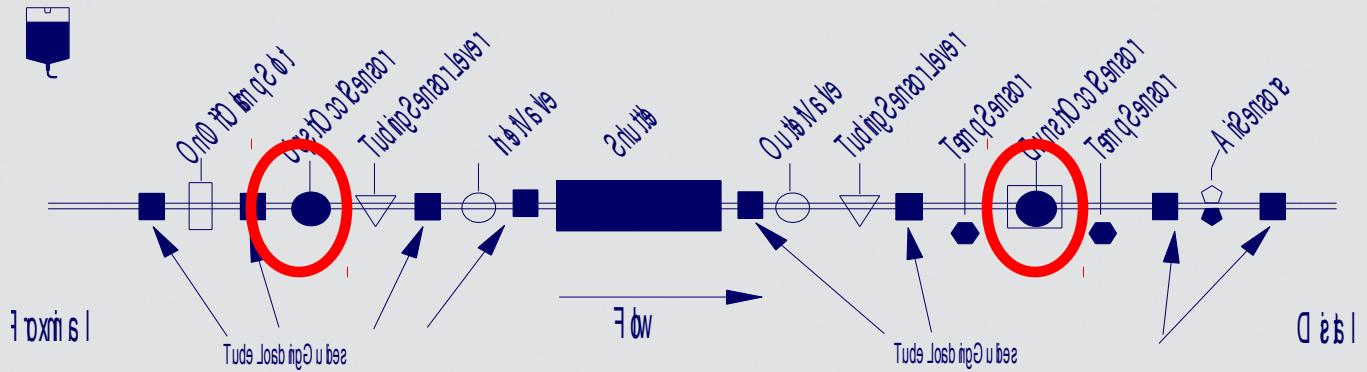
- Occlusion Sensors
- Temperature Sensors
- Air Sensors.

**Baxter**

## RESPOND RESTORE RENEW



## PUMP HEAD MECHANISM - Occlusion Sensors

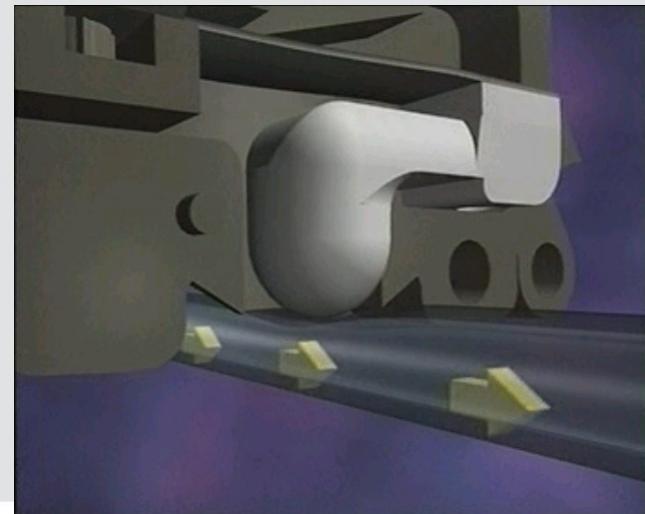


**xter**



# Occlusion Detection

- Cantilever beam strain gauge transducers
- Upstream and downstream transducers are Zeroed at the beginning of an infusion.
- Three sensitivity levels for downstream occlusion
- Flow rate also influences downstream occlusion sensitivity.

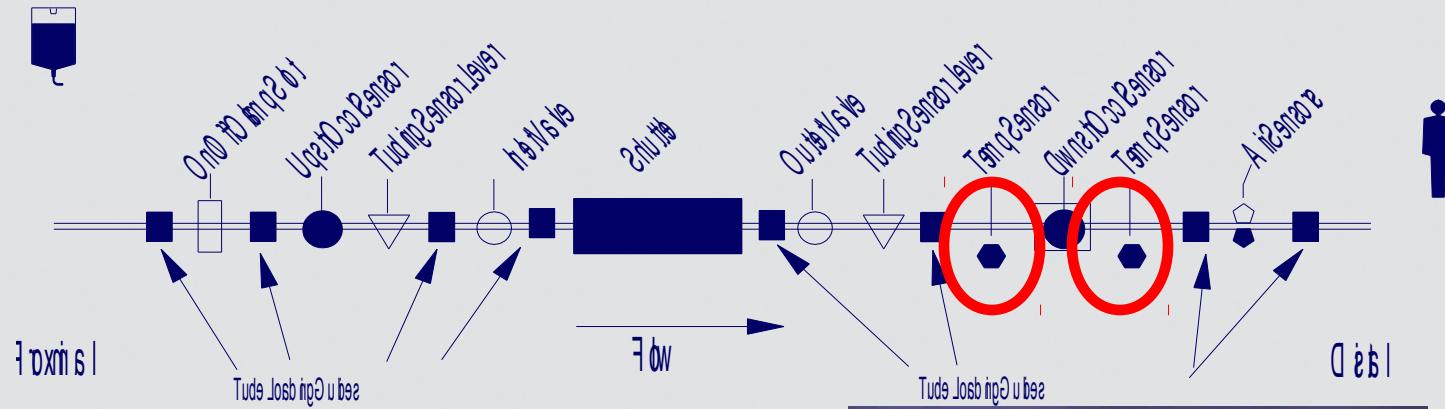


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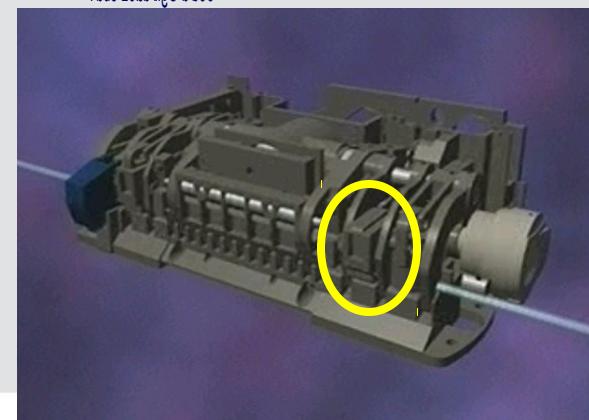
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## PUMP HEAD MECHANISM - Temperature Sensors



- Shuts Pump down if outside  $15^\circ - 38^\circ C$
- Compensates occlusion reaction for changes in tube characteristics

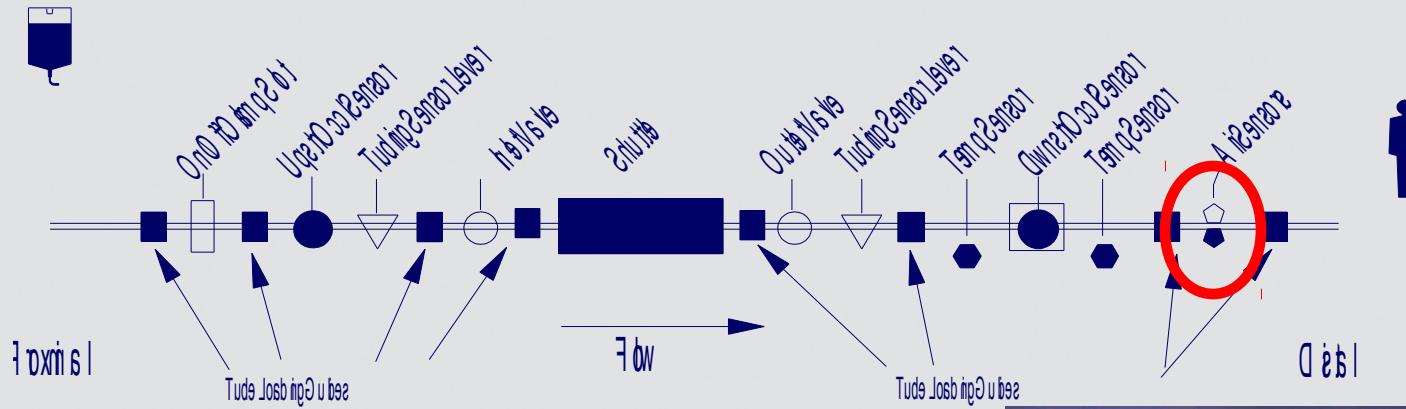


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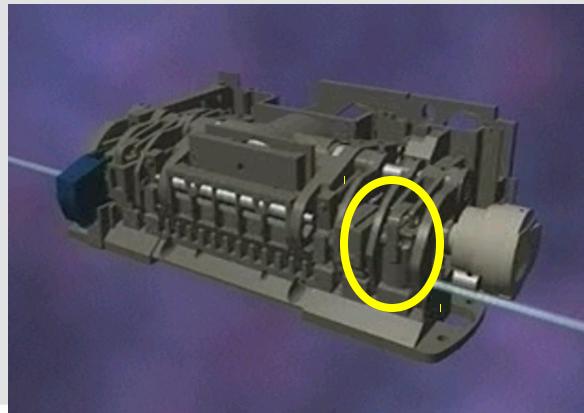
RESPOND RESTORE RENEW



## PUMP HEAD MECHANISM - Air Sensor



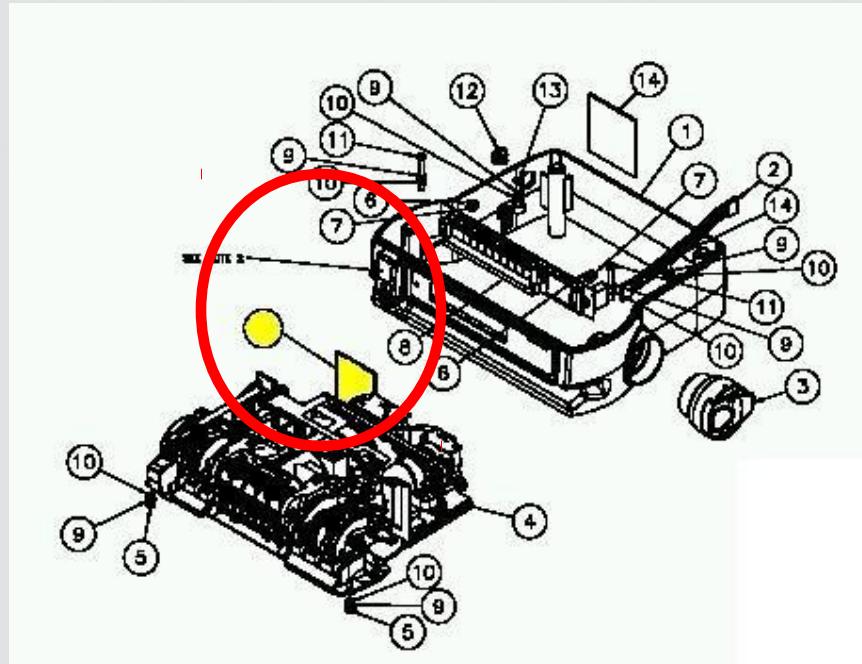
- ◆ Transmitter in fixed lower jaw
- ◆ Receiver in retracting upper jaw
- ◆ 4.5 MHz Ultrasonic signal
- ◆ Samples every 10  $\mu$ l of the infusion.
- ◆ Adds volume of air sensed over volume delivered. .



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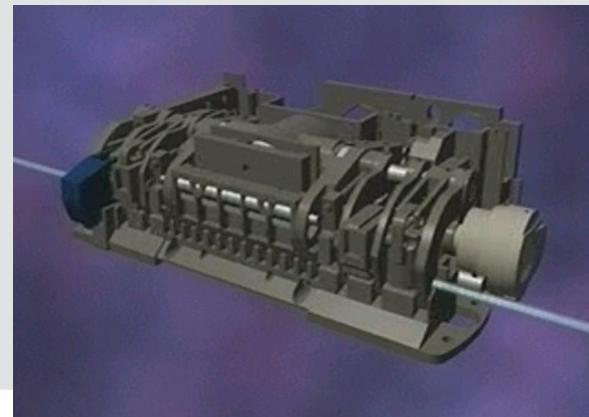


## PUMP HEAD MECHANISM - Air Sensor



Air in Line PCB (AIL PCB)

- ◆ Small Daughter PCB on PHM PCB
- ◆ Conditions Tx and Rx analogue signals for further processing on PHM PCB



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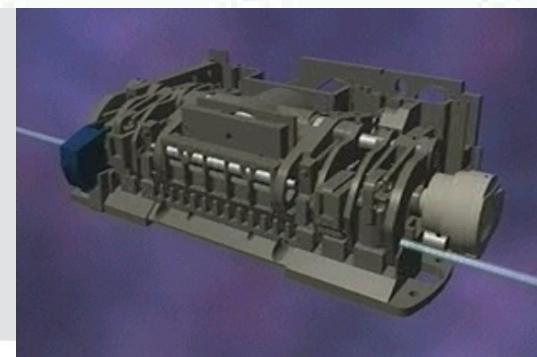
## PUMP HEAD MECHANISM - Air Sensor

Air bubble  
setting  
(alarm  
thresholds)

Approximately:

- 25 microliters of air in 0.83 mL delivered
- 50 microliters of air in 1.67 mL delivered
- 100 microliters of air in 3.33 mL delivered
- 150 microliters of air in 5.0 mL delivered

Air alarm sensitivity is a configurable option.



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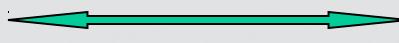
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# Accumulative Air Bubble Size

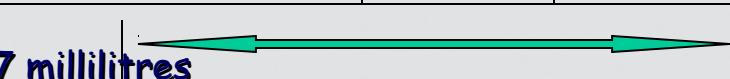
Air setting to 25 microlitres

Air bubble in any 830 microlitres



Air setting to 50 microlitres

Air bubble in any 1.67 millilitres



Air setting to 100 microlitres

Air bubble in any 3.34 millilitres



Air setting to 150 microlitres

Air bubble in any 5.0 millilitres



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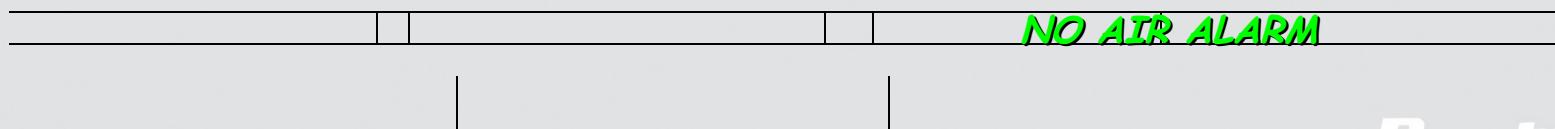
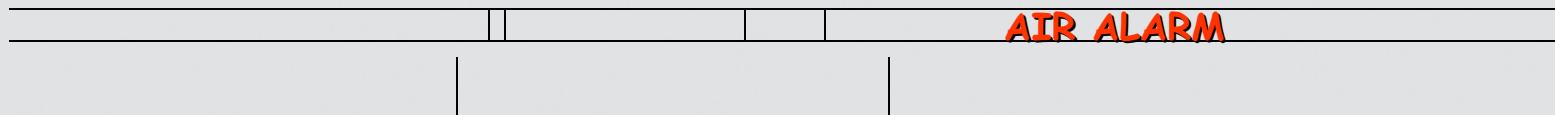
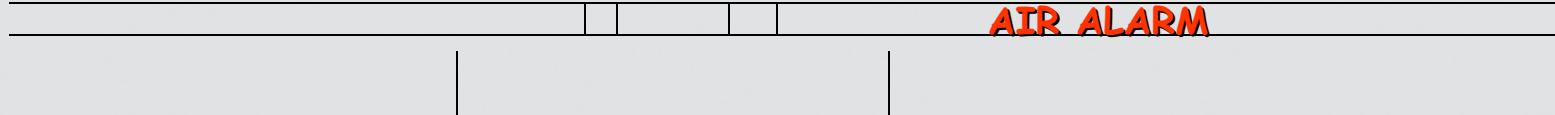


# Accumulative Air Bubble Size

Air setting to 25 microlitres

Air bubble in any 830 microlitres

**AIR ALARM**

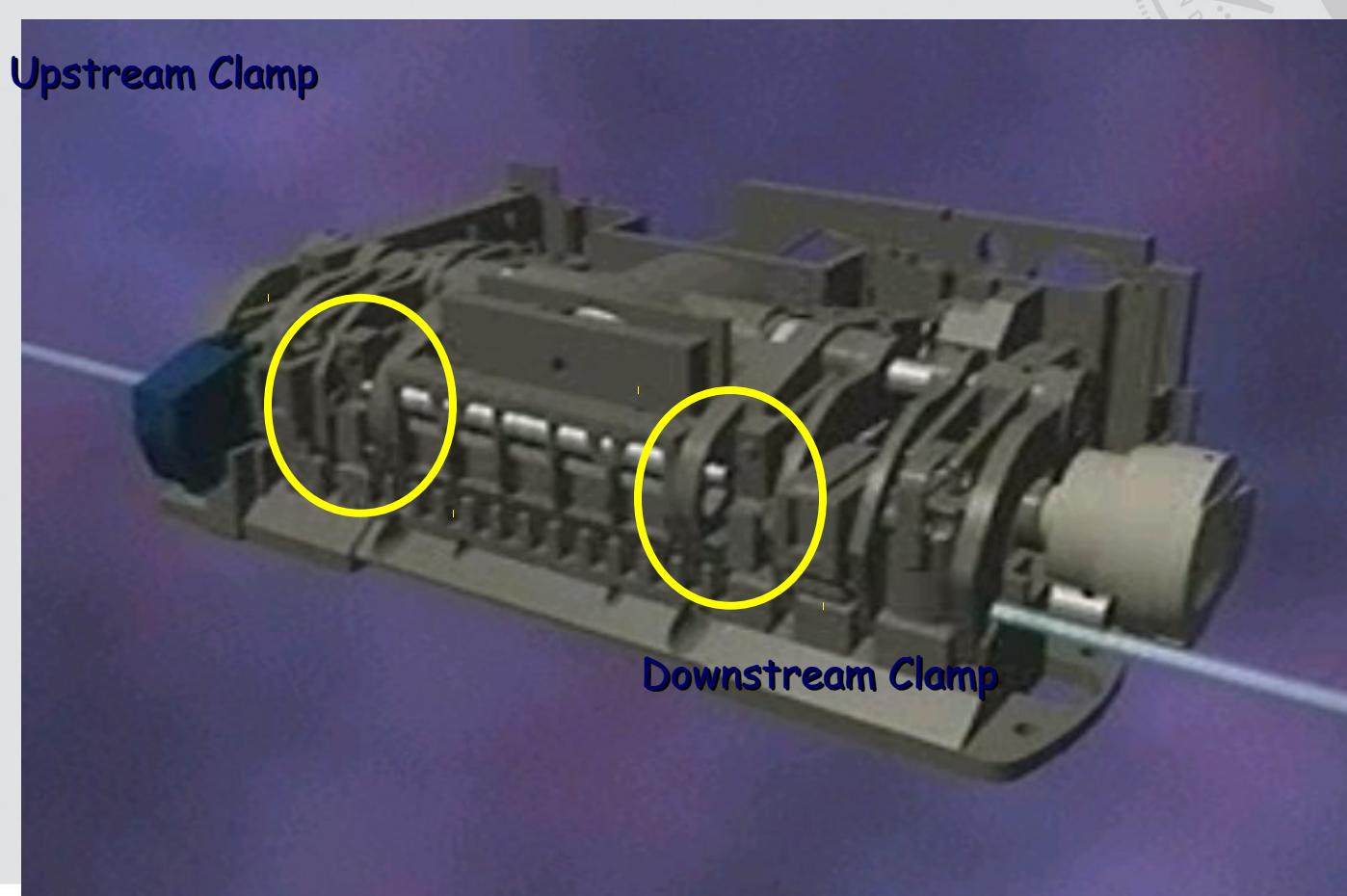


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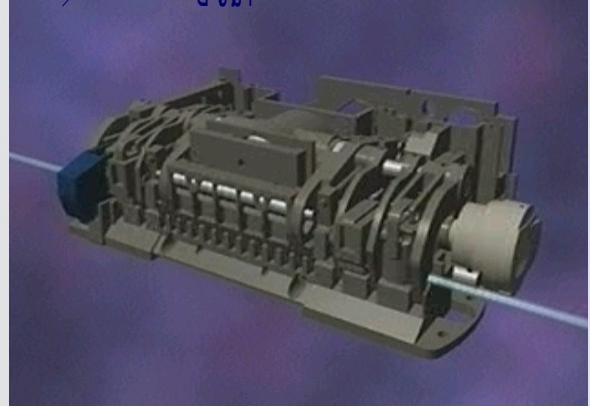
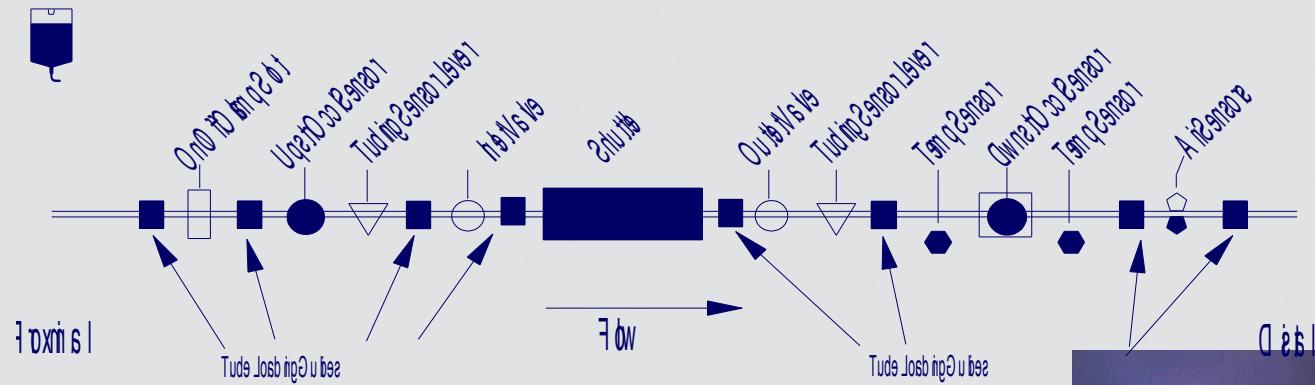
## PUMP HEAD MECHANISM - Clamps



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# PUMP HEAD MECHANISM

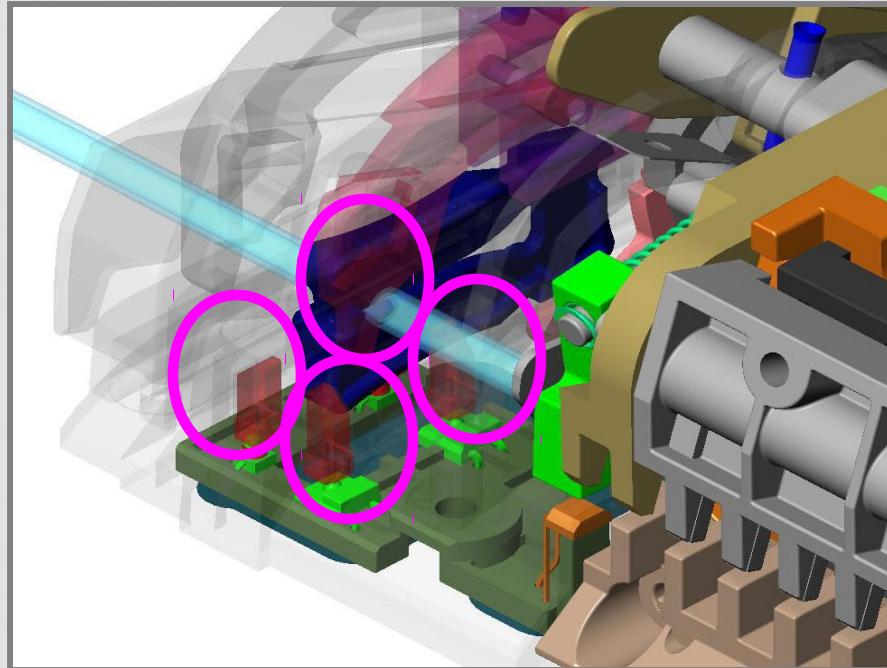


- ◆ Upstream and Downstream Tube Sensing Levers
- ◆ Tube Loading Levers

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# Prisms



Failure Codes related to Prism

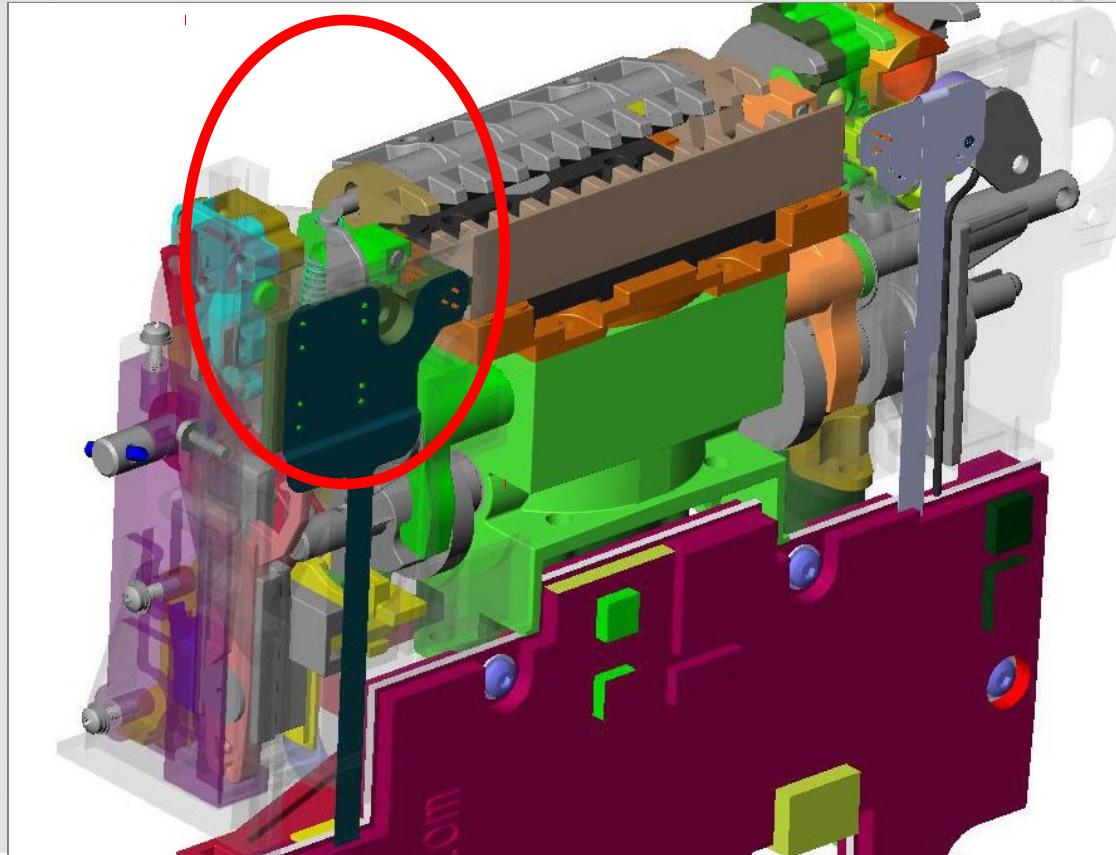
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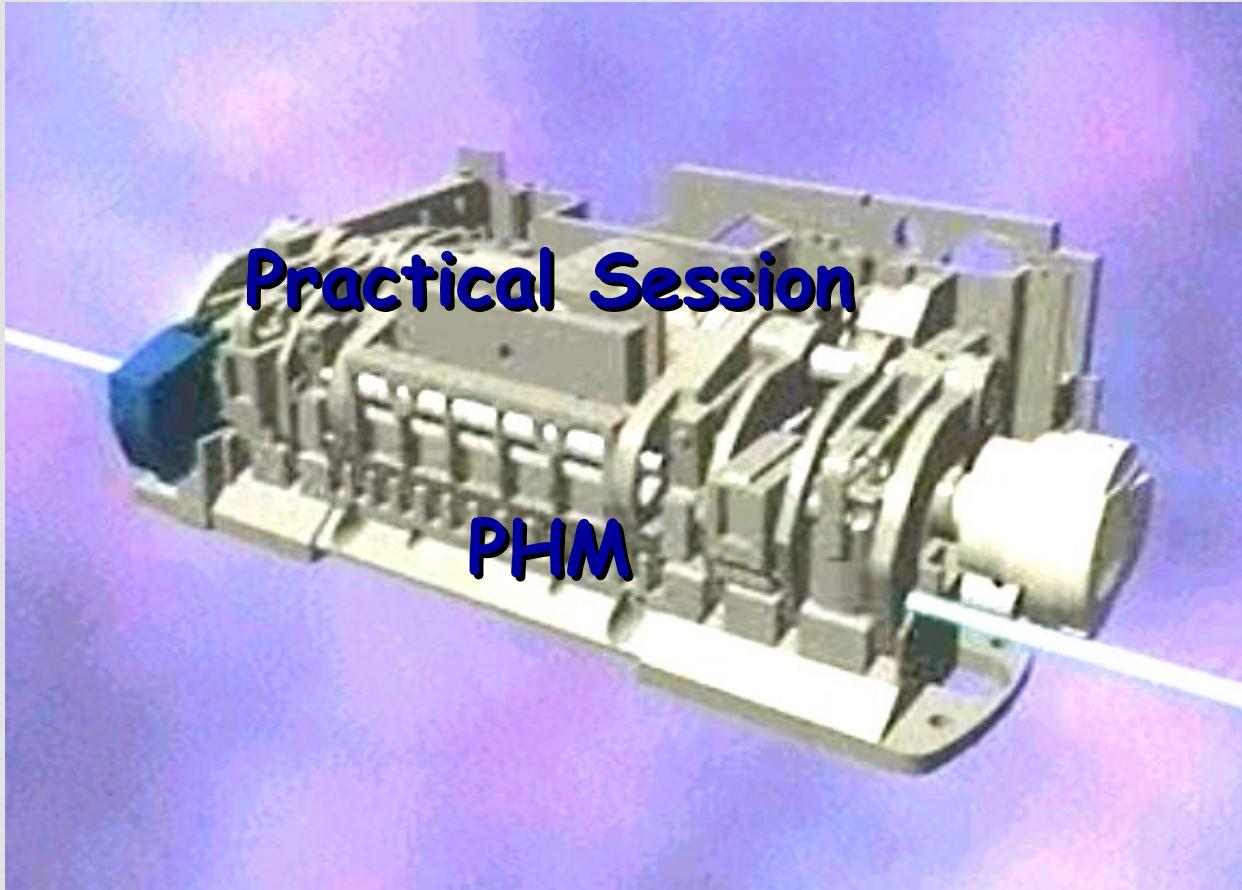


# Prism and Flex Cont.



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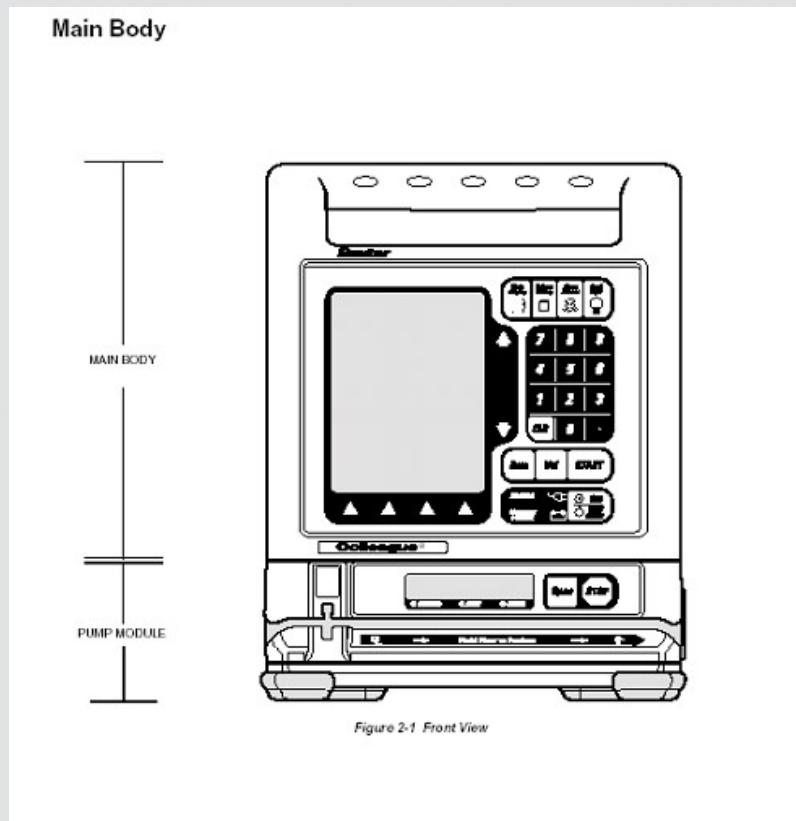


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# The Colleague Pump sections:



User Interface Module (UIM)

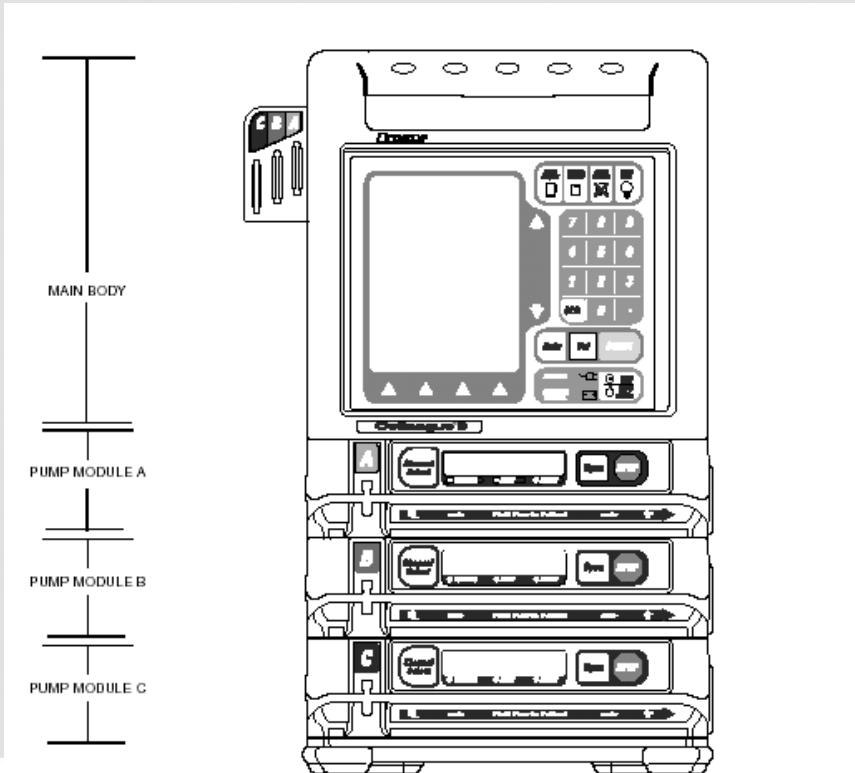
Pump Head Module (PHM)

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# The Triple Channel Colleague Pump sections:



User Interface  
Module (UIM)

Pump Head  
Module (PHM) Channel A

Pump Head  
Module (PHM) Channel B

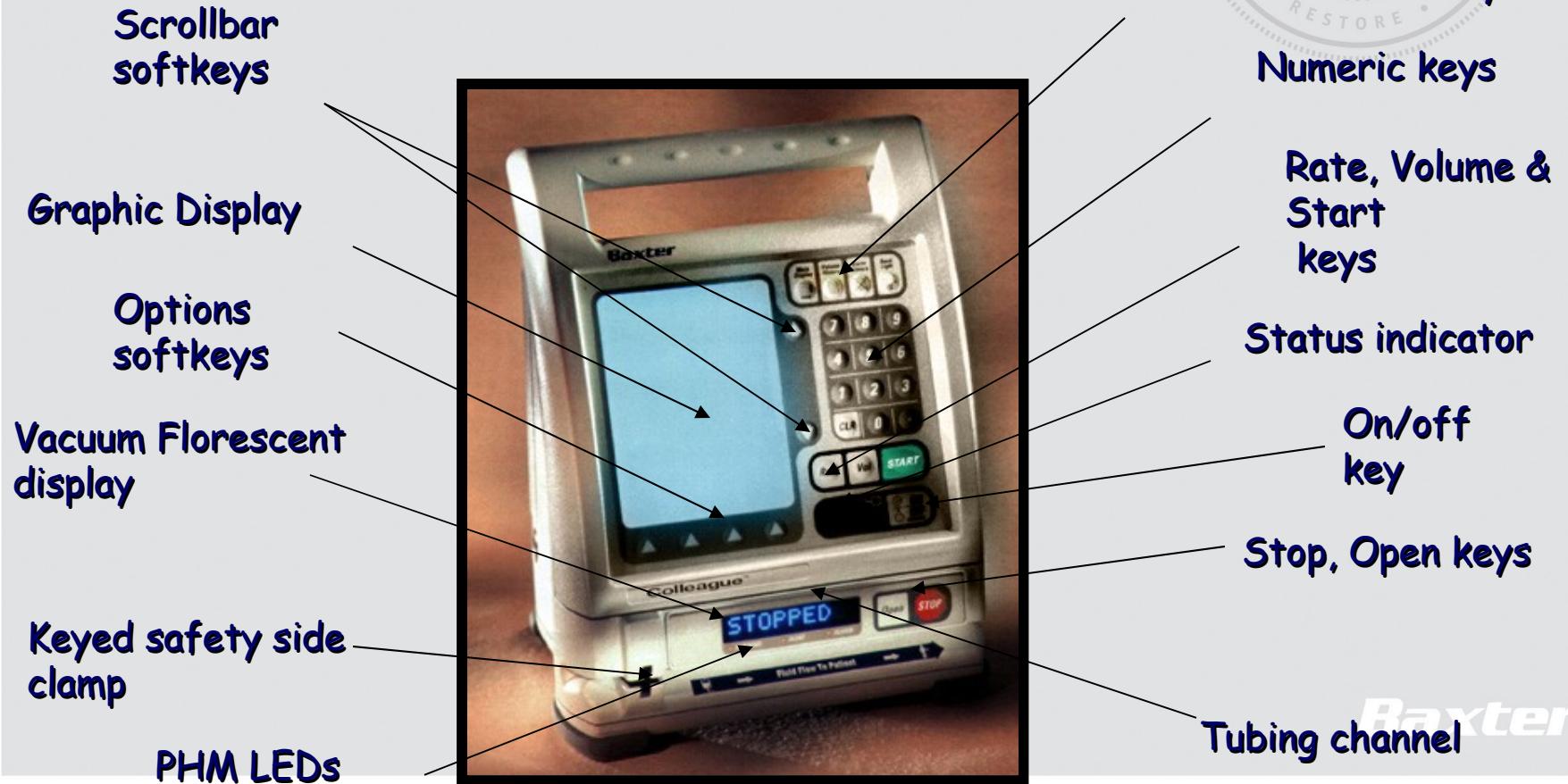
Pump Head  
Module (PHM) Channel C

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## Device Description - Front face



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## Device Description - Rear



Handle

Volume Control

Mains Fuses

Power Cord  
Restraint

Serial Number  
Label

Power Cord

Manual tube  
release

Pumphead  
Module (PHM)

Contrast  
Control

Speaker Vent

Panel Lock Key

ISO Comm  
Port

Backup Buzzer vent  
IV Pole Clamp Knob

Lock Knob 'Wings'

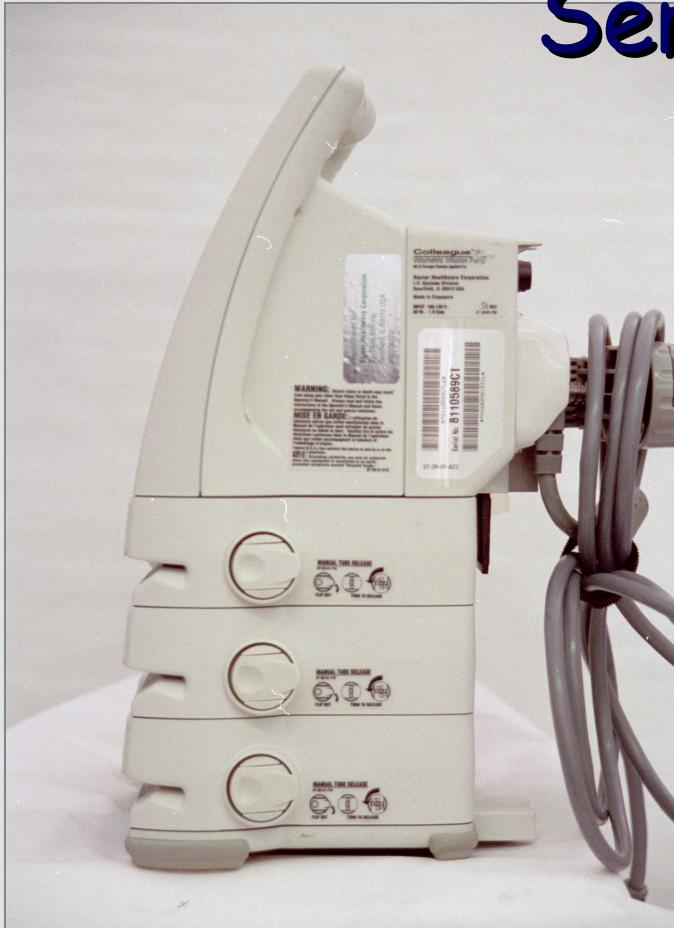
Bed End Plate

**Baxter**  
Feet

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# Serial Number Format



Year of Manufacture  
(10 = 2000, 9 = 1999)      Month of  
Manufacture

10040362CS

Sequential Number      See Table 1-1

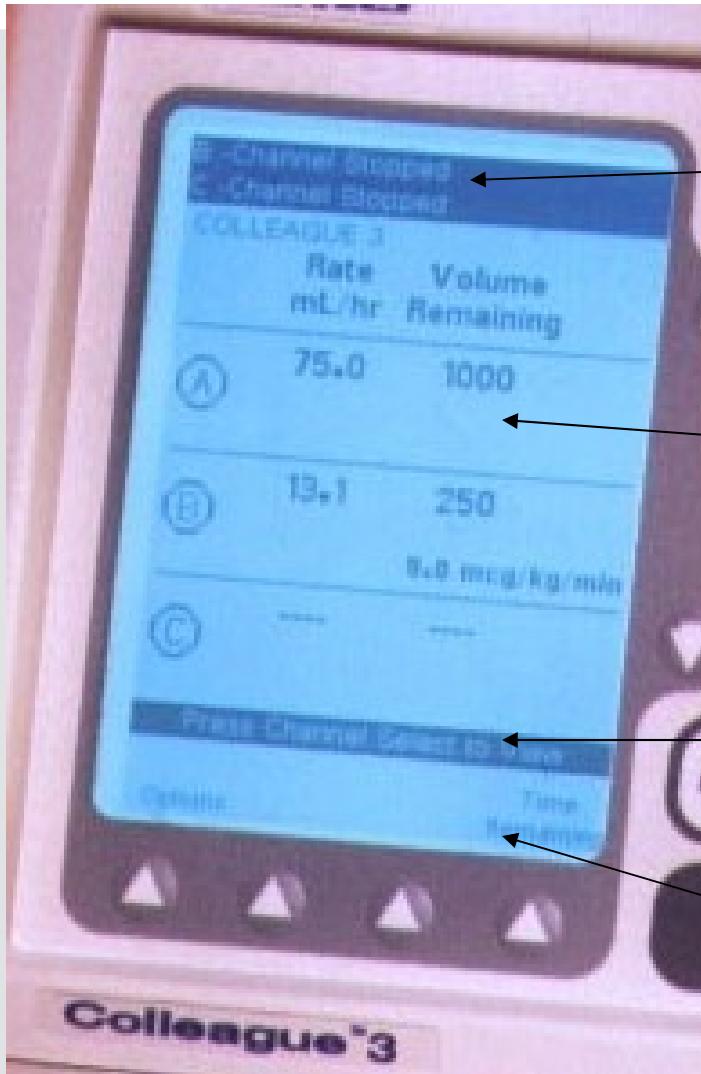
## Examples:

**8060517CS**      U.S. Colleague Pump manufactured June 1998  
**10025678TG**      German Colleague 3 Pump manufactured Feb. 2000  
**11081234TE**      Spanish Colleague 3 Pump manufactured Aug. 2001

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# Device Description - Display & Softkeys



Information line

Main Display Area

Prompt Line

Softkey legend line



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# Colleague 1 & 3 Specifications



## Colleague 1

- Weight 10.7 lbs - 4.7kg
- Dimensions 254mm x 197mm x 187mm
- Voltage range 95 to 260 volts
- Battery back-up  
(12V x 2 ampere hours lead acid)
- Battery Life 7 hours to 2.5 hours (dual battery)  
@100ml/hr
- Flowrate range Pri 0.1 - 1200ml/hr  
Sec 0.1 - 500ml/hr
- Volume limit up to 9999ml
- Shuttle technology
- Ultra-sonic air detection (4.5MHz)  
Settings 25, 50, 100, 150 micro-litres
- Cantilever beam strain gauge  
Upstream & downstream occlusion  
Monitoring: positive & negative pressures
- Programmable KVO rate 0.1- 5ml/hr

## Colleague 3

- 17.5lbs - 7.9kg
- 353mm x 197mm x 203mm
- as C1
- as C1
- 3 hours to 2 hours x 3 channels @  
100ml/hr
- as C1

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# Service Manual



- **C1 & C3 combined Global Service Manual Pt No. 0719H2646**
- **Manual Organization:**
  - **Chapter 1 Introduction - General Safety Advice**
  - **Chapter 2 Description & Technical Specification**
  - **Chapter 3 Preparation for Use**
  - **Chapter 4 Accessories**
  - **Chapter 5 Configuration & Service Features**
  - **Chapter 6 Routine Maintenance**
  - **Chapter 7 Troubleshooting**
  - **Chapter 8 Removal/ Replacement Procedures**
  - **Chapter 9 Calibration**
  - **Chapter 10 Operational Checkout**
  - **Chapter 11 Illustrated Parts Breakdown**
  - **Chapter 12 Theory of Operation**
  - **Chapter 13 Diagrams**



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# Colleague Alarms & Alerts

- An alarm can be reported to the user while the pump is in the ON state, whether in stopped or running mode.
- During stop mode it will usually report an internal device error.
- During running mode an alarm will report a device internal error or a situation which requires user intervention.
- Alarms STOP the infusion to the patient.
- An alert will inform the user that attention is required, such as, in stopped mode, low battery, infusion complete & pump in KVO mode.
- Some alerts, such as low battery, if not attended to, may become alarms.



- The Colleague pump monitors for safe administration of solutions to the patient.
- It has a self-loading mechanism which makes it simpler for the set to be loaded into the device.
- It automatically unlocks and locks the blue anti-free-flow slide clamp when the set is loaded and unloaded.
- During the infusion the pump monitors for blockages upstream and downstream of the pump (occlusions).
- During the infusion, the pump monitors for air being delivered to the patient.
- At the end of an infusion the pump will deliver at a pre-programmed KVO (Keep Vein Open) rate to the patient.
- If attention is required before or during the infusion the user will be notified by an Alert or Alarm from the pump.
- Alerts and Alarms are both visual and audible.
- A secondary audible back-up alarms exists should the main audio circuit fail.

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## Switching on the Colleague

- **Controls and Operating the Colleague**



## Switching on the Colleague - self-test process

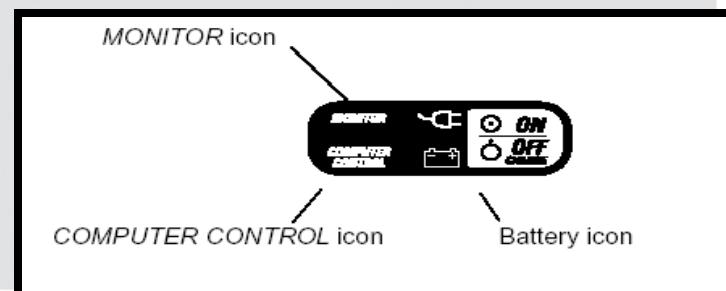
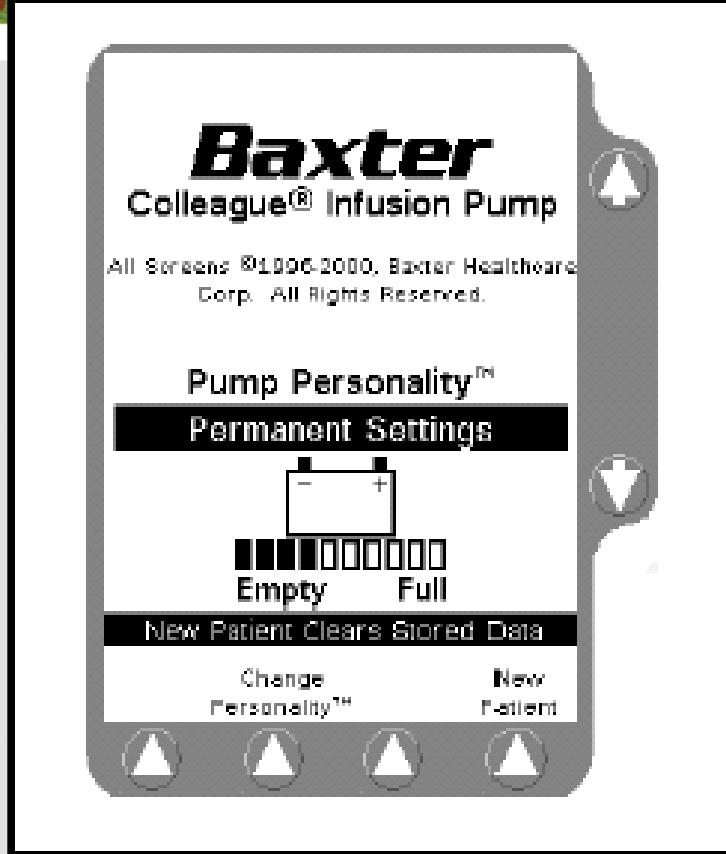
checks internal systems.

- When Test Passes, device prepares itself for user input.
  - Opening the channel
  - Loading the set
  - Inputting infusion information
  - Starting the infusion.
- The self-test is important as the device reports any Errors encountered during Self Test.
- Allows the user the opportunity to check
  - the audible alert and alarm tones,
  - the displays and the
  - charge status of the battery.
- Self Test often ignored by users.
- Problem detected during this phase, must be addressed to prevent any complications later



# The Start Up Self-Test

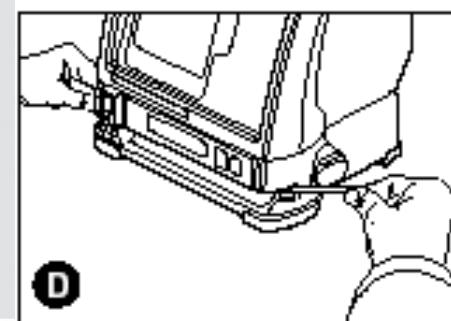
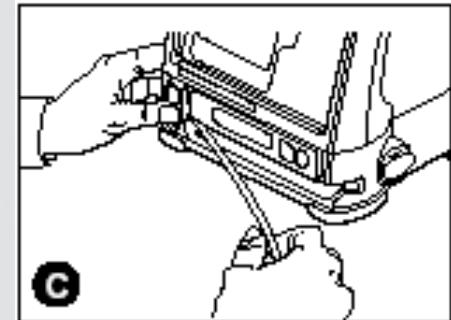
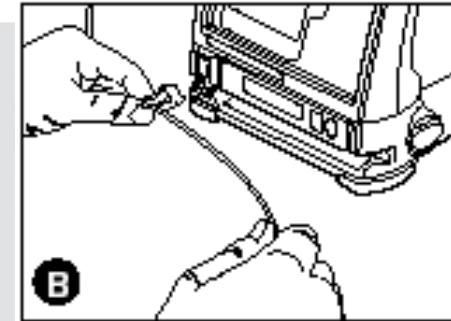
- When the device is turned on, as well as the internal checks the user should be aware of the visual and audible signals.
- The power status icons:**
  - Mains or battery
- The battery status:**
  - The user can view the charge on the battery and if powered via battery, ensure no low battery alert or flat battery alarms
- The visual messages:**
  - The main display - look for any error messages
  - The channel display
  - The channel status LED's RED, AMBER, GREEN
- The audible tones:**
  - Three tones in total. Two from back-up speaker, one from main speaker



# Opening the Channel & Loading the Set

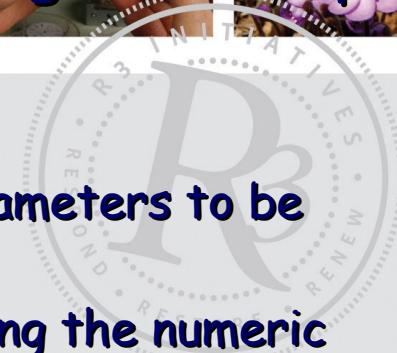


- At the end of the self-test, if no alerts or alarms have occurred the pump is ready to use.
- To load the set, simply press the channel open button.
- The channel will open. This will take approximately 3 seconds.
- While the channel is open, an arrow will indicate direction of flow to the patient "---→".
- Using a primed administration set, with the blue safety slide clamp in the closed position, introduce the tubing and slide clamp into the channel.
- Load it straight into the tubing channel. Hold the tubing firmly, but not tightly, to the rear of the channel.
- The channel will close automatically.
- Again this process will take about 3 seconds and a message "LOADING" will be displayed.
- If a tube misload occurs remove the tubing and try again.



# Keying in the Infusion Parameter & Starting The Pump

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- With the set loaded the pump is ready for the parameters to be keyed in.
- From the Main Screen, by pressing Vol. key and using the numeric keys, enter the desired volume in millilitres (e.g. 100ml).
- If an error is made press the CLR key on the keypad and re-enter the volume.
- Press the RATE key and enter the desired rate (e.g. 125ml/hr).
- Open the roller clamp on the set and press the green START key.
- The infusion will commence.
- The Stop sign will change to a drip icon.
- The green running LED will illuminate.
- Drips will appear in the drip chamber.
- The 'Time Remaining' and 'Volume to be Infused' will count down.
- The rate that the pump is running at will appear in the PHM display.
- Fluid will be delivered to the patient.

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# Testing the Alarms and Alerts



- The ALARM TONE is three rapid beeps, a gap and three rapid beeps....
- The Functional Test for a Downstream Occlusion.
  - With the pump running, pinch the tubing downstream of the pump.
  - The pump will stop and 'Downstream Occlusion' will be displayed together with an audible alarm. The RED LED on the PHM will illuminate.
  - Release the tubing and the pump will re-start automatically.

## The Functional Test for an Upstream Occlusion.

- With the pump running, pinch the tubing above the pump.
- The pump will stop and 'Upstream Occlusion' will be displayed together with an audible alarm.
- Release the tubing and the pump this time WILL NOT restart.
- You must press the primary or rate key and start key to restart the pump.



# Testing the Alarms and Alerts



## The Functional Test for the Air Detection System.

- Again with the pump running press the rate key followed by 500 on the numeric keypad.
- The pump will alert with the message 'New Rate'.
- The delivery rate will not change until the start key is pressed.
- With the pump running at the new rate, invert the drip chamber so air is pumped down the giving set.
- When an air bubble approximately 25mm in length is visible in the set below the drip chamber return the drip chamber to its normal position.
- Allow the pump to run until an 'Air Detected' alarm occurs.
- Press the Alarm Silence key and the audible alarm will be muted for two minutes.



# Testing the Alarms and Alerts



## Dealing with an Air Alarm

- The screen will display DO YOU WANT TO ADVANCE THE AIR TO VIEW THE AIR BUBBLE?
- Press the YES key (up arrow soft key)
- Press and hold the Advance Air soft key.
- The pump will run at the programmed rate and the air bubble will travel along the tubing, exiting the pump channel.
- This allows the user to view the air bubble size and make a clinical decision regarding the air alarm.
- The advance air key will allow no more than 400ul (microlitres) to be advanced.
- Once the air bubble has finished advancing, the pump will display FLUID where it had previously displayed air.
- The pump will be ready to start. This time the start key need only be pressed to resume the infusion.



## Testing the Alerts



- The ALERT TONE is a single tone then a long space, repeatedly.
- The main alerts on the device are:
  - 2 minute stopped mode
  - KVO mode
  - Low battery
- An alert message indicates that the pump requires attention.
- Program the pump to deliver 2mls at a rate of 500ml/hr.
- Start the pump.
- After the 2mls has been delivered the pump will enter KVO mode, the alert LED will illuminate and the KVO rate will be displayed on the pump.
- The cause of an alert message should be investigated by the user.
- For example, if a battery low alert is ignored, it will become an alarm.

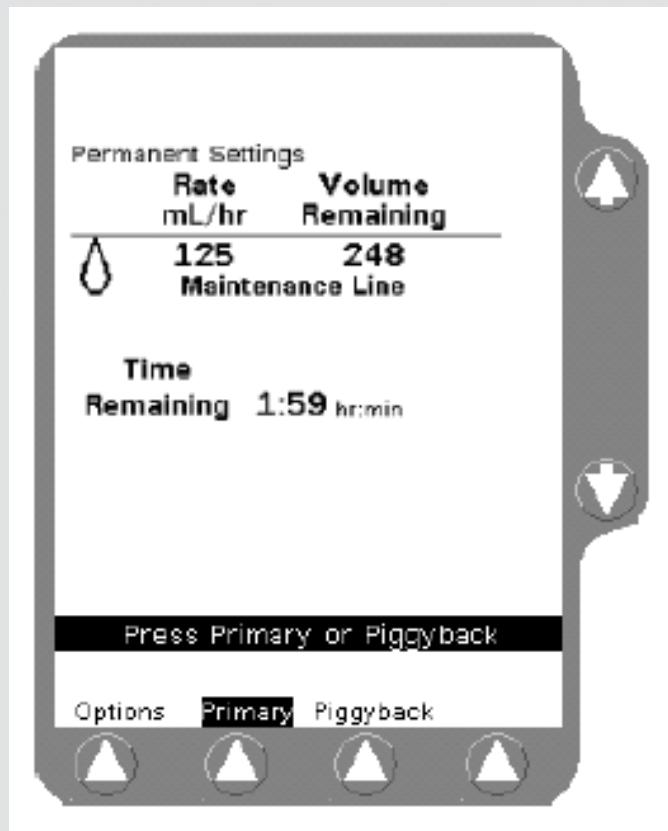


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# The Options Menu



- From the main screen select the Options Softkey:



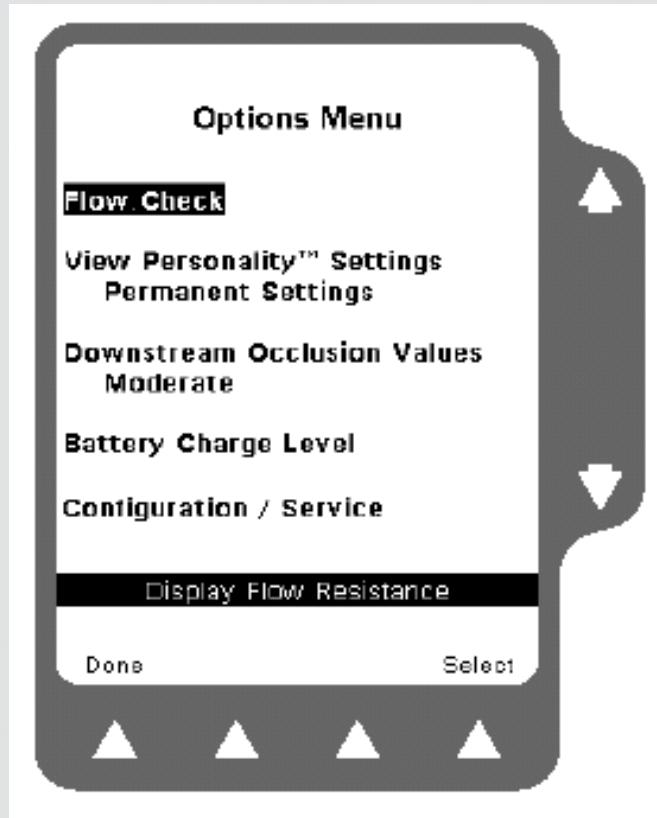
**Baxter**

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# Flow Check Graphic



- Selecting FLOW CHECK gives a graphical representation of how close the pump is running to the downstream occlusion level selected



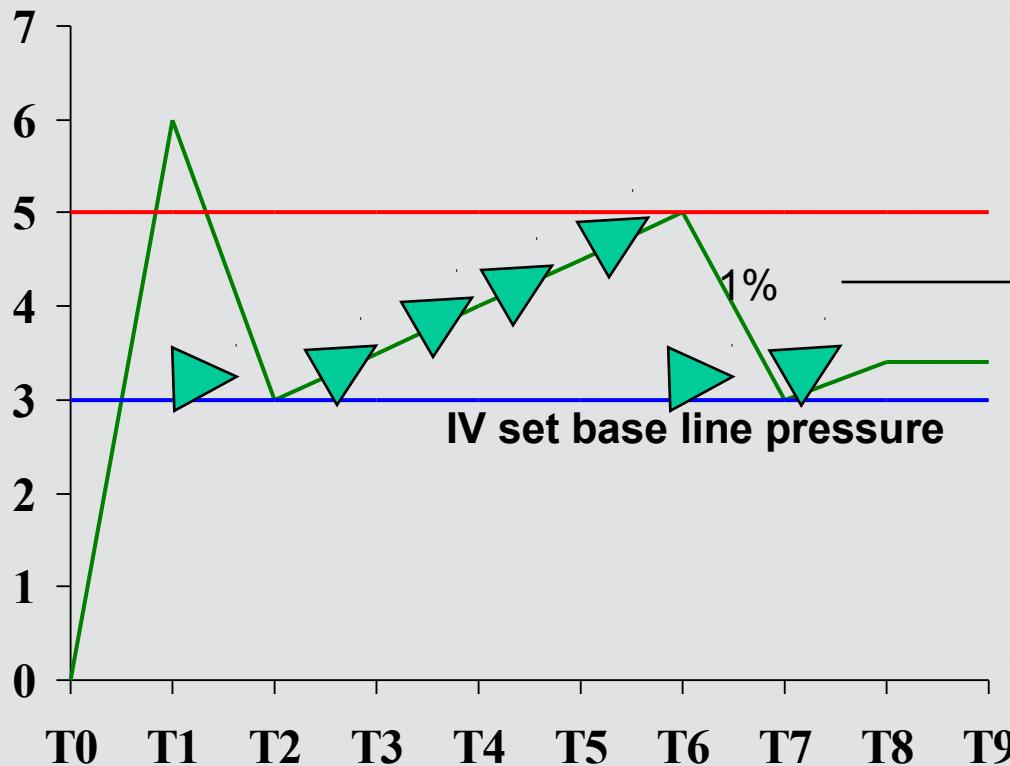
oxter

RESPOND RESTORE RENEW

# Colleague Pressure System



Alarm limit =  
IV set base line pressure + Colleague Alarm limit



- T0 to T2 IV set settling on sensor
- T2 Start key pressed
- T2 to T6 pump running, pressure rising
- T6 Occlusion alarm
- T6 to T7 equals 60 Seconds, Pressure needs to fall 1% for the pump to start
- T7 to T9 pump restarted

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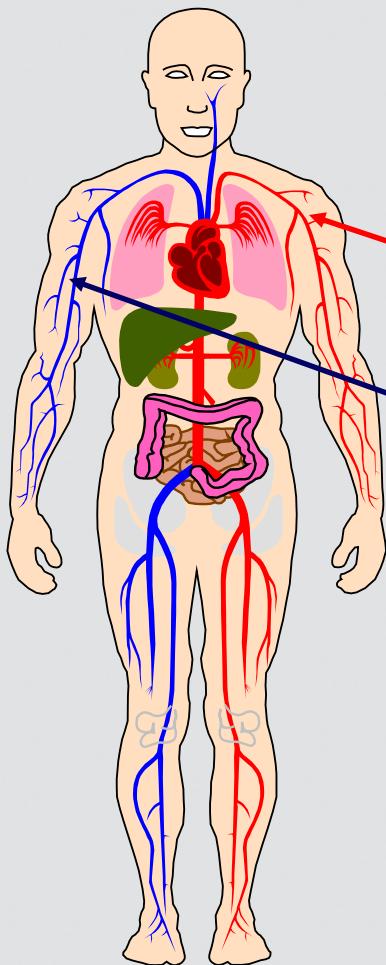


# Colleague® Occlusion Pressure





# Pressure in the Body



- Arterial pressure approx. 100mmHg
- Peripheral venous pressure 5 -80 mmHg
- Veins have mono-directional flow, as the veins are lined with valves called cusps.

# IV Line Pressure

RESPOND RESTORE RENEW



## NORMAL INFUSION

### IV Set PRESSURE

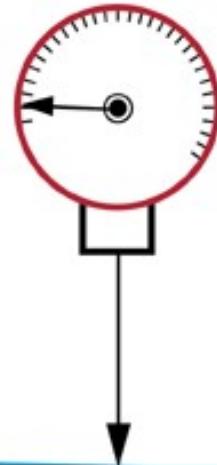
Normal, but slightly higher than the venous pressure to overcome restriction of catheter

### VENOUS PRESSURE

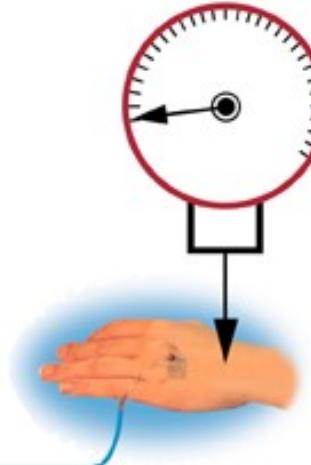
Normal (about 15mmHg)



**All pumps only generate pressure to overcome resistance to flow. Therefore, low resistance means low pressure.**



To create flow IV set pressure needs to be greater than venous pressure.

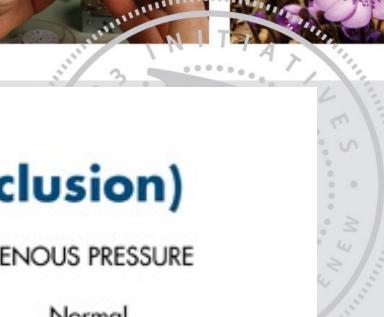


Therefore, cannot measure venous pressure while the pump is running.



# IV Line Pressure

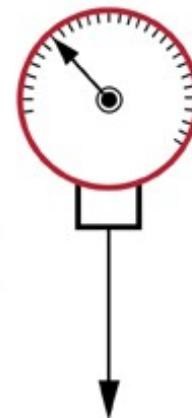
RESPOND RESTORE RENEW



## IV SET KINKED (Slight flow restriction/partial occlusion)

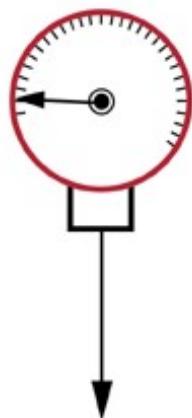
### IV Set PRESSURE (1)

High enough to overcome restriction of kink



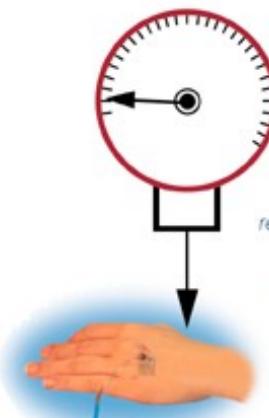
### LINE PRESSURE (2)

Normal, but slightly higher than venous pressure to overcome restriction of catheter



### VENOUS PRESSURE

Normal



When resistance to flow (partial occlusion) occurs, the pumping action creates pressure to push fluid past the restriction. The pump will not alarm unless pressure in the IV set exceeds a pre-set limit.

Downstream of the partial occlusion, pressure in the IV set is as before, just enough to overcome the Catheter.

**dexter**

# IV Line Pressure

RESPOND RESTORE RENEW



## IV SET BLOCKED (Total occlusion)

### IV Set PRESSURE (1)

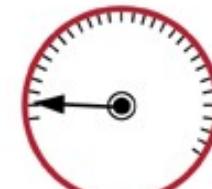
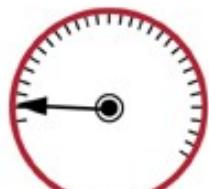
High and rising.  
Will eventually  
cause alarm

### IV Set PRESSURE (2)

Normal

### VENOUS PRESSURE

Normal



High resistance to flow (occlusion)  
causes an occlusion alarm pumping  
pressure exceeds preset limit  
upstream of the occlusion.

Downstream of the occlusion  
IV set pressure = venous  
pressure (no flow to patient).

er



## How Does the Colleague pressure system work?

- The Colleague Downstream occlusion pressure sensor is a mechanical beam that flexes when the tube shape changes. The flex of the beam is measured by a strain beam, this generates a signal that the microprocessors convert into a pressure.
- When pressure is applied to the tube the tube expands, the amount of expansion is proportional to the pressure in the line. This is demonstrated in Figure 1.
- When the IV set is loaded into the pump head the sensor is pushed back, this causes a peak in the signal output (Figure 2,T1). The sensor then settles on to the IV set.
- The moment the user presses the start button, the Pump takes 4 pressure readings. These 4 readings are averaged to set the base line pressure. (Figure 2,T2)
- What is the base line pressure (Figure 2, blue line)?  
The base line pressure is the pressure created in the IV set by the surrounding infusion conditions. The pump treats this base line as 0mmHg. The pump will then alarm at the alarm threshold above the base line. I.e. Flowrate 10ml/h pressure set at minimum alarms at 103mmHg above IV set base line



## How Does the Colleague pressure system work

- Why is it important that the roller clamp is open BEFORE pressing the start button?
  - The roller clamp needs to be open before start is pressed so the pump uses the true system pressure to set the base line. The true system pressure can include pressures generated by the following sources:
    - Multi way stopcocks
    - Micro bore tubing
    - Vein pressure
    - Other infusion products
- During the infusion as an occlusion occurs the triangles on the flow check will turn black, this can be seen in Figure 2. When all 5 triangles are black the pump alarms Occlusion. What happens next depends on whether the auto restart option is configured and the reason for the occlusion alarm.

# Colleague Pressure System



## Occlusion Pressure

- ⇒ Clinical Importance of Occlusion pressure alarms
  - ⇒ Inform the user of non delivery of the prescription
- ⇒ The two factors that are Clinically important
  - ⇒ Time to Alarm
  - ⇒ Post Occlusion Bolus

### Time to Detect Downstream Occlusion

Rate	Occlusion Alarm	Typical Time to	Maximum Time to
	Pressure Setting	Alarm Activation	Alarm Activation
	Minimum 103 mmHg	4 min 6 sec	7 min 59 sec
1 ml/h	Moderate 252 mmHg	7 min 24 sec	13 min 44 sec
	Maximum 465 mmHg	13 min 48 sec	26 min 58 sec
	Minimum 206 mmHg	0 min 17 sec	0 min 27 sec
25 ml/h	Moderate 413 mmHg	0 min 32 sec	0 min 52 sec
	Maximum 620 mmHg	0 min 47 sec	1 min 12 sec

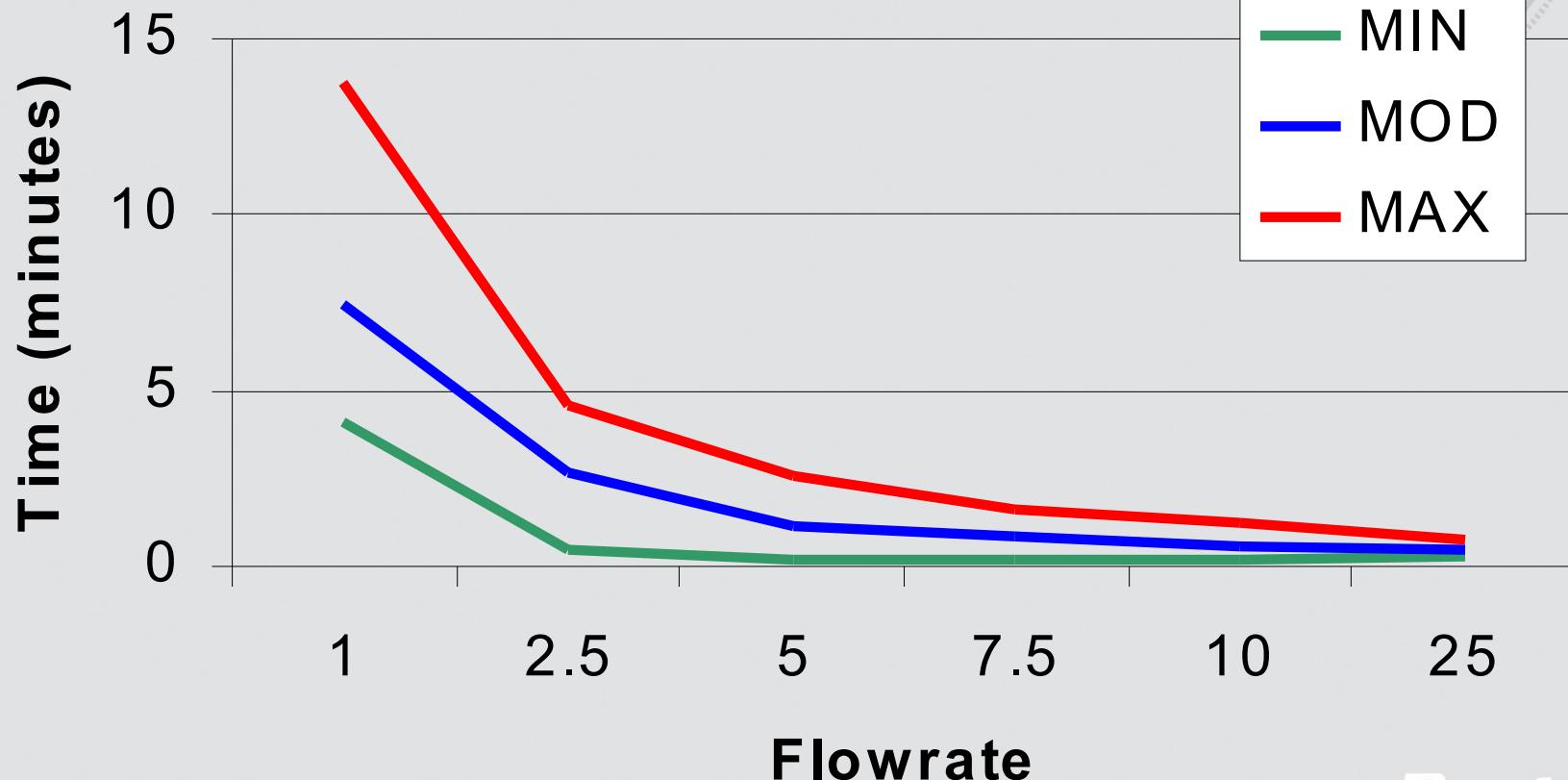
### Bolus Volume After Downstream Occlusion

Rate	Occlusion Alarm	Typical Bolus	Maximum Bolus
	Pressure Setting	Volume	Volume
	Minimum 103 mmHg	0.057ml	0.16ml
1 ml/h	Moderate 252 mmHg	0.110ml	0.20ml
	Maximum 465 mmHg	0.177ml	0.26ml
	Minimum 206 mmHg	0.079ml	0.20ml
25 ml/h	Moderate 413 mmHg	0.178ml	0.55ml
	Maximum 620 mmHg	0.245ml	0.72ml

RESPOND

# Colleague Pressure System

## Colleague Time to Occlusion



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# In-Line Resistance to Flow

RESPOND

Flow Rate Below 21ml/hr:-  
RESTORE RENEW



Settings	System Pressure	Approximate – in line resistance to flow mm/Hg			
Minimum	<input type="checkbox"/>	25 <input type="checkbox"/>	50 <input type="checkbox"/>	75 <input type="checkbox"/>	103 <input type="checkbox"/>
Moderate	<input type="checkbox"/>	64 <input type="checkbox"/>	128 <input type="checkbox"/>	192 <input type="checkbox"/>	258 <input type="checkbox"/>
Maximum	<input type="checkbox"/>	106 <input type="checkbox"/>	212 <input type="checkbox"/>	318 <input type="checkbox"/>	465 <input type="checkbox"/>

Flow Rate 21-200ml/hr:-

Settings	System Pressure	Approximate – in line resistance to flow mm/Hg			
Minimum	<input type="checkbox"/>	52 <input type="checkbox"/>	103 <input type="checkbox"/>	155 <input type="checkbox"/>	207 <input type="checkbox"/>
Moderate	<input type="checkbox"/>	103 <input type="checkbox"/>	206 <input type="checkbox"/>	309 <input type="checkbox"/>	414 <input type="checkbox"/>
Maximum	<input type="checkbox"/>	155 <input type="checkbox"/>	310 <input type="checkbox"/>	465 <input type="checkbox"/>	620 <input type="checkbox"/>

Flow Rate 200ml/hr & above:-

Settings	System Pressure	Approximate – in line resistance to flow mm/Hg			
Minimum	<input type="checkbox"/>	77 <input type="checkbox"/>	155 <input type="checkbox"/>	232 <input type="checkbox"/>	310 <input type="checkbox"/>
Moderate	<input type="checkbox"/>	143 <input type="checkbox"/>	286 <input type="checkbox"/>	429 <input type="checkbox"/>	569 <input type="checkbox"/>
Maximum	<input type="checkbox"/>	194 <input type="checkbox"/>	388 <input type="checkbox"/>	582 <input type="checkbox"/>	775 <input type="checkbox"/>



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# Colleague Pressure Sensor

RESPOND RESTORE RENEW



- Strain Beam Technology
- Compensated for Temperature
- Colleague® 1 and 3 pressure systems are identical

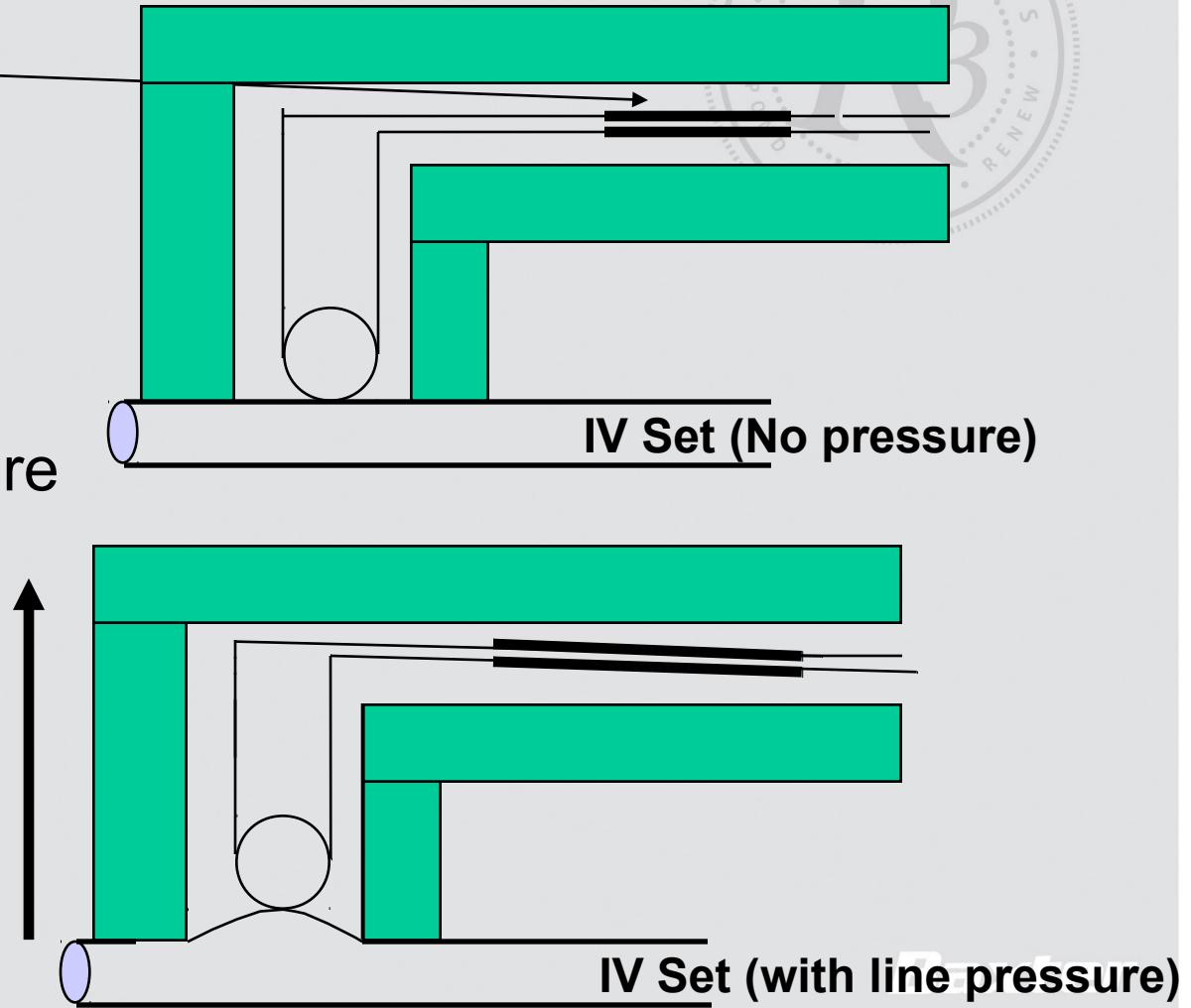
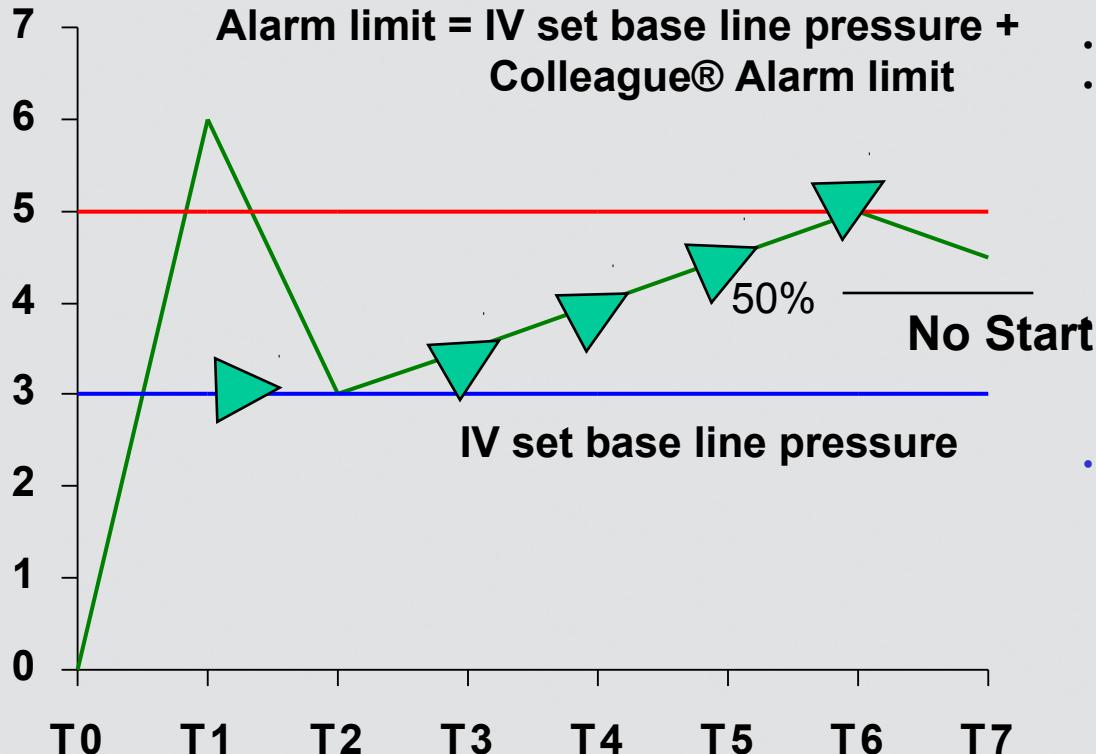


Figure 1

# Colleague Pressure System



Figure 2



Represents Triangles on Colleague® flow check display

- T0 to T2 IV set settling on sensor
- T2 Start key pressed
- T2 to T6 pump running, pressure rising
- T6 Occlusion alarm
- T6 to T7 equals 60 Seconds, pressure needs to fall 50% for the pump to start. In this case the pump will not start because the pressure has not fallen to 50% of the alarm limit. In this example that equals 4. The pump will stop and allow the user to press start. The pump will restart if the pressure has fallen by 1%
- If you select the next occlusion alarm limit the pump will restart, see figure 4

# Colleague Pressure System

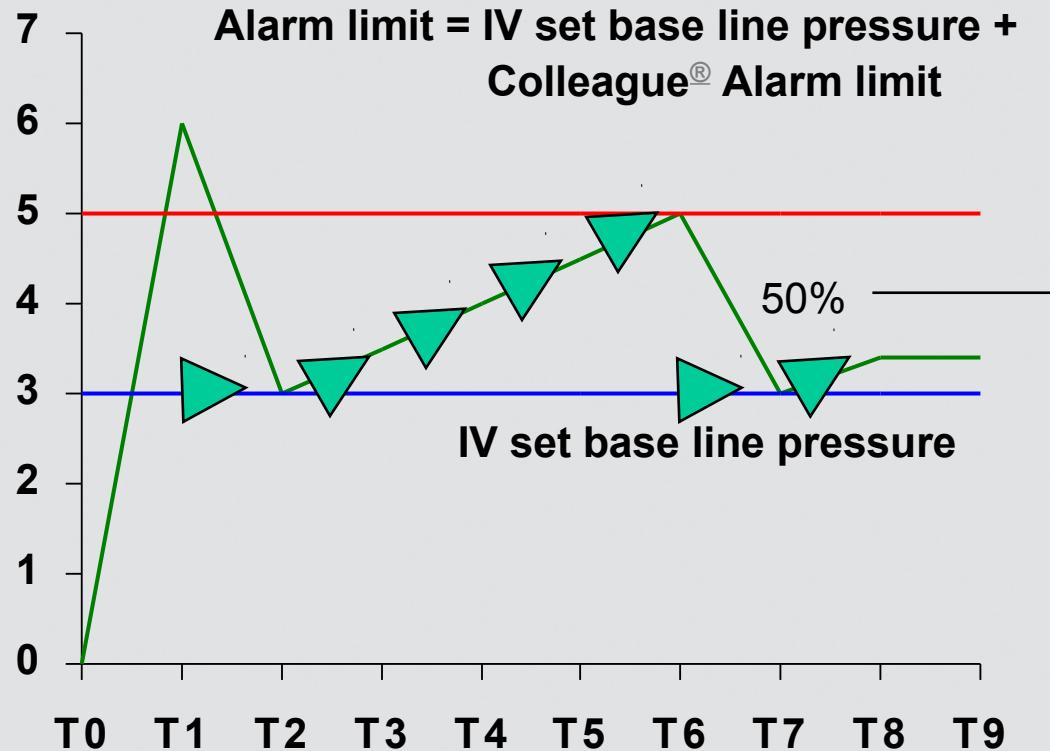


Figure 3

- T0 to T2 IV set settling on sensor
- T2 Start key pressed
- T2 to T6 pump running, pressure rising
- T6 Occlusion alarm
- T6 to T7 equals 60 Seconds, Pressure needs to fall 50% for the pump to start
- T7 to T9 pump restarted

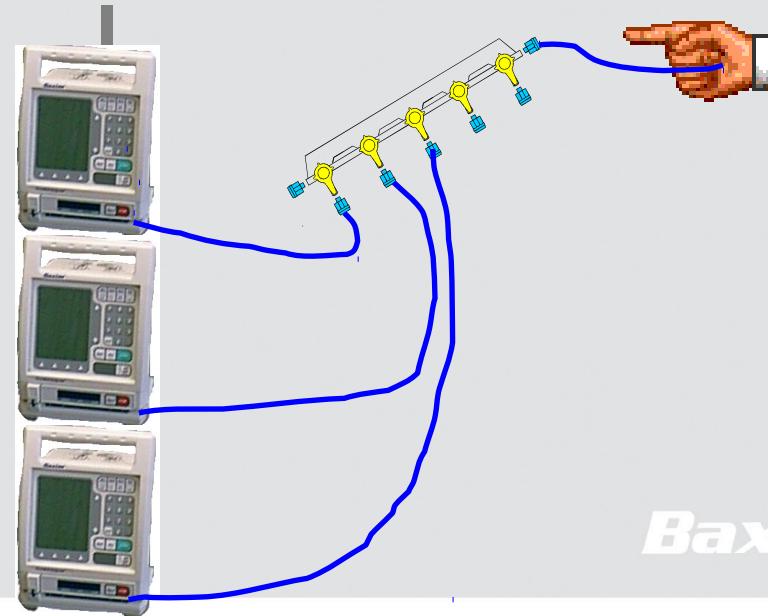
# What is a Parallel infusion

RESPOND RESTORE RENEW



- Parallel Infusions are the practice of using a multi port device so that more than one infusion can enter the patient through a single line.
- The infusions can be a combination of gravity, syringe pump and volumetric pump. In addition it may also include a bolus delivered manually by a syringe.
- In order for all the infusions to correctly operate the background pressure will rise in order for flow to take place.
- If another infusion or manually delivered bolus is introduced after a period of time, this may cause some infusion products to alarm 'Occlusion'

## Parallel Infusion



# Why is time to alarm important for accuracy

RESPOND RESTORE RENEW



## Slow time to Alarm

- Flowrate 60ml/h
- Time to alarm for occlusion 10 minutes
- Fluid volume not delivered during 10 minutes equals 10ml
- **Accuracy error = 16% + pump error**

## Fast time to Alarm

- Flowrate 60ml/h
- Time to alarm for occlusion 5 minutes
- Fluid volume not delivered during 5 minutes equals 5ml
- **Accuracy error = 8% + pump error**

**Always remember, the clinically accuracy of a volumetric infusion pump improves with faster alarm response times.**

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# Infiltration



- **“Monitoring of in line pressure is not useful for predicting or detecting infiltration of peripheral catheter sites in infants. The method lacks sensitivity, is too specific, and has poor predictive and detective ability.”**

Reference : Phelps.S.J

“Inability of inline pressure monitoring to predict or detect infiltration of peripheral intravenous catheters in infants”

Clinical Pharmacy 1990

# Infiltration



- **“Conclusion**

**The results indicate that the pressure transducer of the IVAC 565 is accurate at measuring in-line pressure. However, there is no conclusive evidence of predictive changes in pressure which occur prior to infiltration and the measurement of in-line ‘resistance’ clinically is not feasible”**

Reference : S.Smith, M.Hall and Pairaudeau

“A clinical and in vitro assessment of a variable pressure pump relating to neonatal infusions”

ITCM,January / February 1991

# Infiltration



- Historically, the nurse has been the sole monitor of the catheter site; however, nurse monitoring is usually limited to periodic visual assessments of the catheter insertion site or to assessment following an infusion device alarm. While nursing assessment remains the "gold" standard in infiltration detection, appearance of the clinical signs of infiltration (i.e., local oedema, induration, inability to get a flashback, etc.) often occur too late or are not prominent enough to prevent serious patient injury. Although several types of infusion devices with some form of infiltration monitoring ability have been marketed, ***there is no scientific evidence that any of the currently marketed infusion devices that use pressure to detect infiltration are capable of predicting or detecting infiltration in any patient population.***

Reference : <http://www.abbothosp.com/prod/edds/CME/CME10.html>

18/03/99



## • Cause of Infiltration

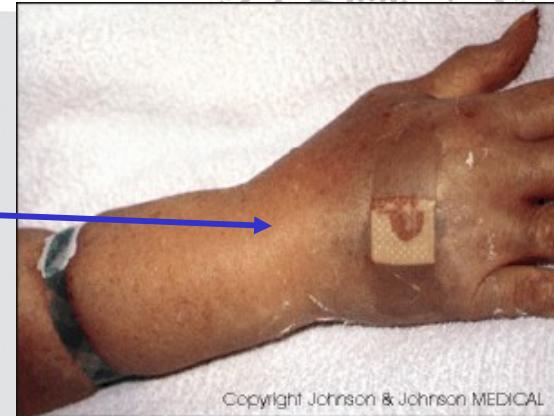
- 1. Dislodgement of the distal tip of the cannula into the tissues surrounding the vein.
- 2. Constriction of the blood flow distal to the cannula tip, which increases venous pressure and allows fluid to leak from the hole in the vein made by the cannula.
- 3. The nature of the drug administered. A number of cytotoxic drugs are known to lead to extravasation therapy, but other drugs which are hypertonic or that have extreme pH (Clarke 1997).

# Effect of Infiltration

RESPOND RESTORE RENEW

- Effect on Patient

- Swelling around catheter entry
- Pain
- Redness around entry
- Tissue damage



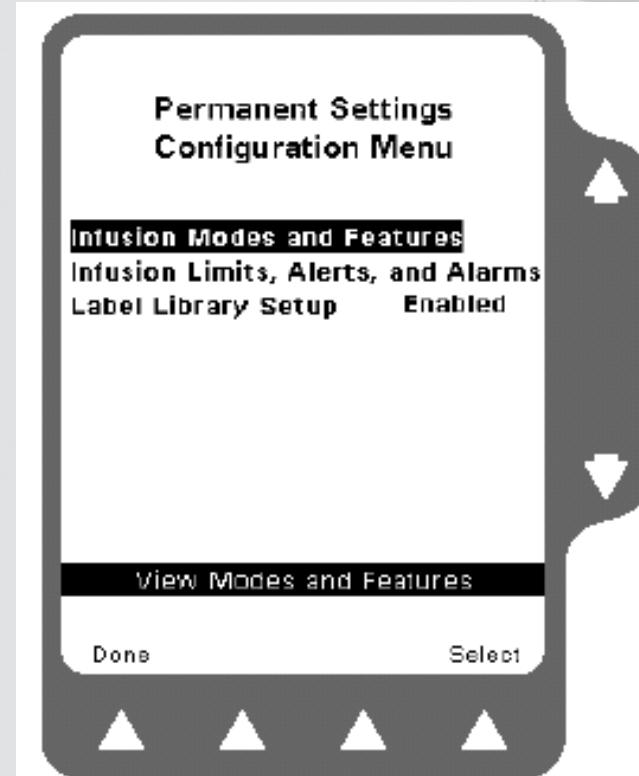
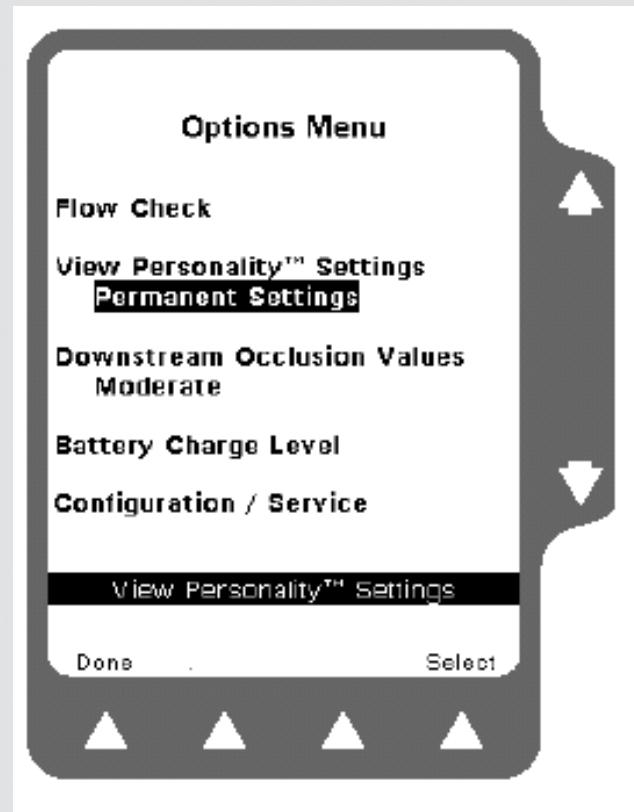
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# View Personality Settings

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- Selecting **VIEW PERSONALITY SETTINGS** allows review of the current personality feature set in the pump

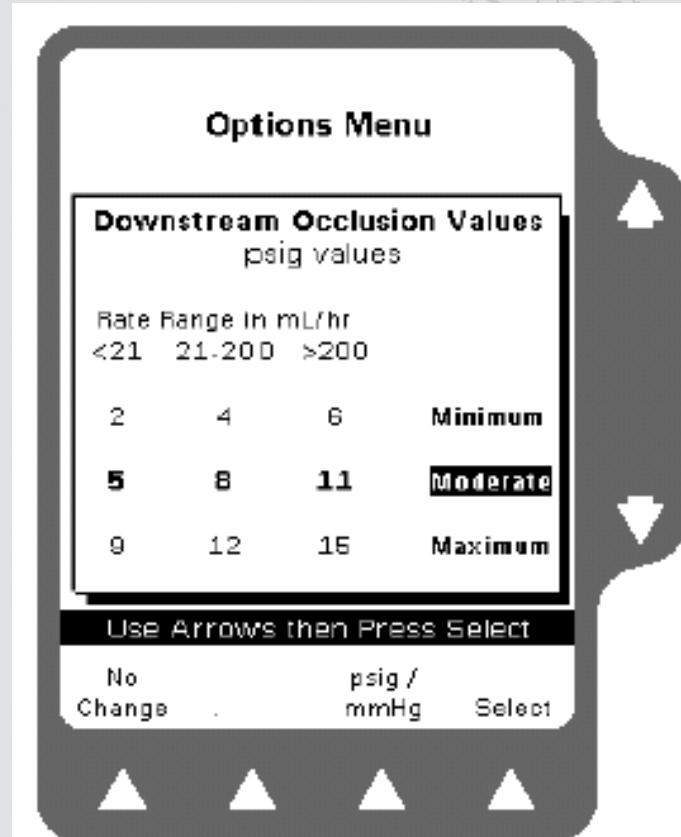


**axter**

# Downstream Occlusion Pressure



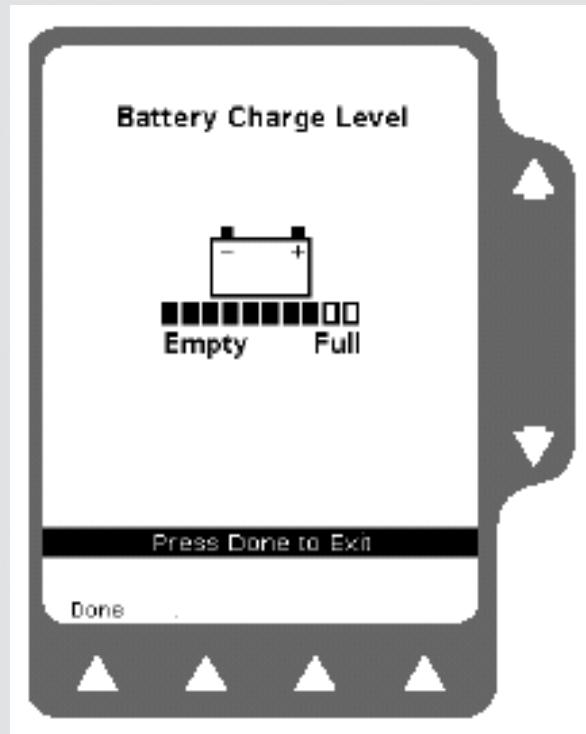
- There are three setting for Downstream Occlusion:
- Minimum, Moderate, Maximum
- The occlusion pressure is rate dependant



# The Battery Charge Level



- The charge of the battery can be viewed from the Options screen by selection of the Battery Charge Level.



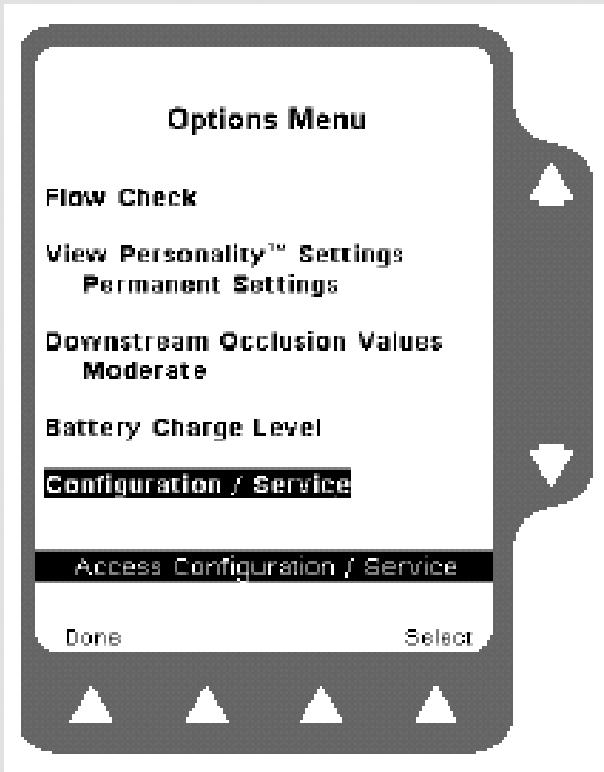
All 10 boxes filled in means the battery is fully charged.

# Configuration / Service

RESPOND RESTORE RENEW



- Once selected you can view the software version in the pump.
- To configure a Personality or use the Service Features a PASSCODE must be entered.
- The passcode is not known by all users.
- It is 8151 in both single and triple devices.



We will look at the Configuration Service screens later.

Pressing the DONE key will return you to the MAIN screen.

**Baxter**

# The Manual Tube Release (MTR)



- The manual tube release is not for use under normal circumstances.
- It is for 'emergency use only'.
  - That is - if the pump is connected to a patient and total power failure occurs on the device, it is not possible to unload the set from the pump.
- The manual tube release allows the user to remove the tubing from the pump without power so the infusion may be continued with another pump.
- Historically many of the issues revolve around the inadvertent use of the MTR.
- If the pump will not turn on for example - **RESET** the MTR.



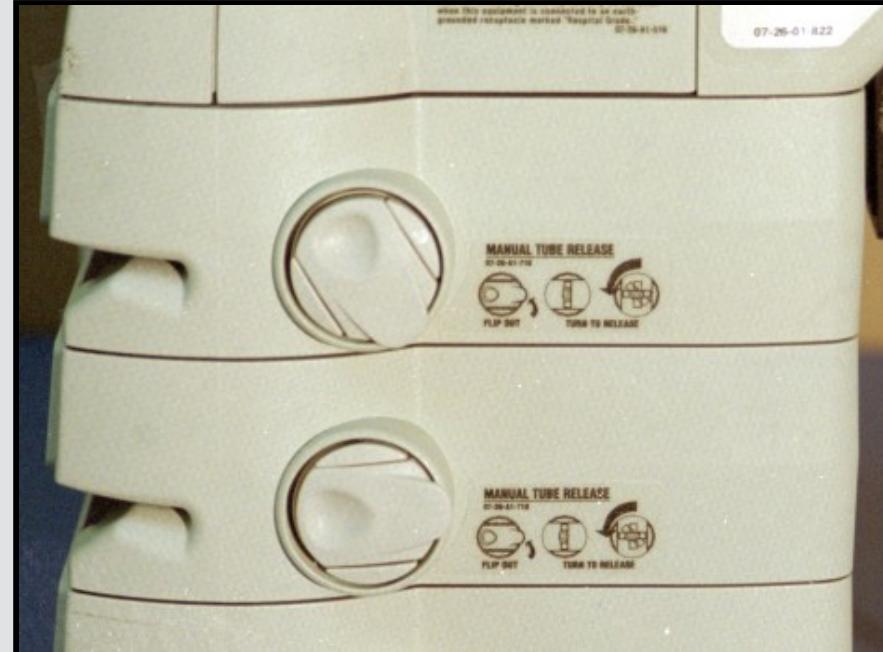
RESPOND RESTORE RENEW

# The Manual Tube Release (MTR)



RESET the MTR.

"HOME" Position for  
MTR.

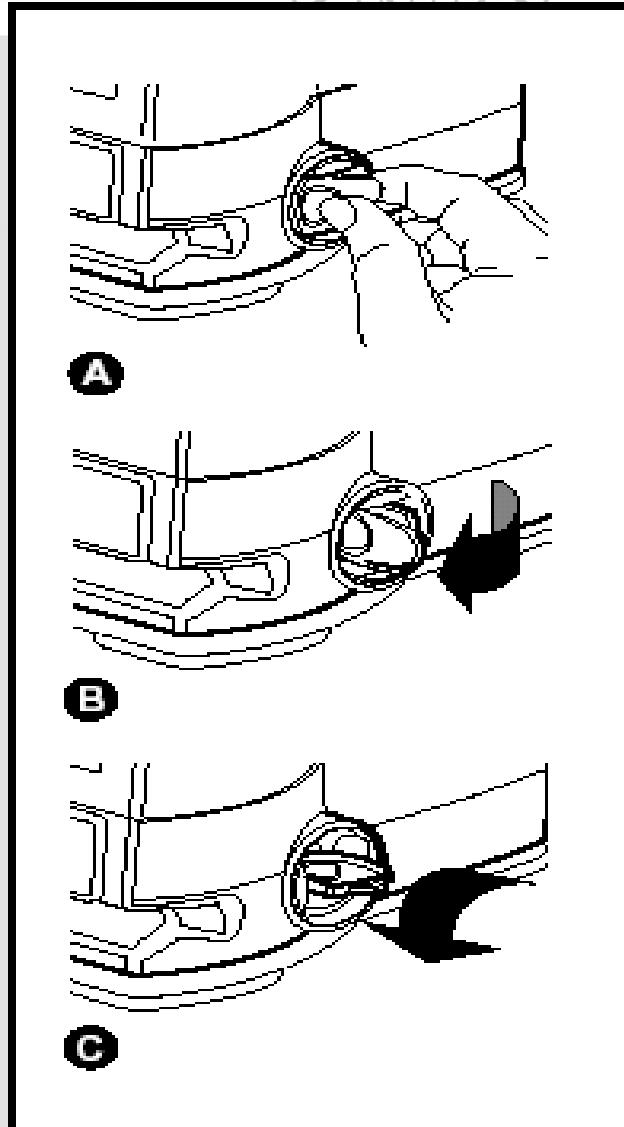


**Baxter**

# The Manual Tube Release (MTR)



- With the pump switched OFF, open the flap on the MTR.
- Rotate the knob counter-clockwise.
- This will open the jaws that encapsulate the set and allow the set to be withdrawn.
- Note the blue safety slide clamp anti-free-flow device will close automatically on the tubing.
- This prevents inadvertent delivery of fluid to the patient.

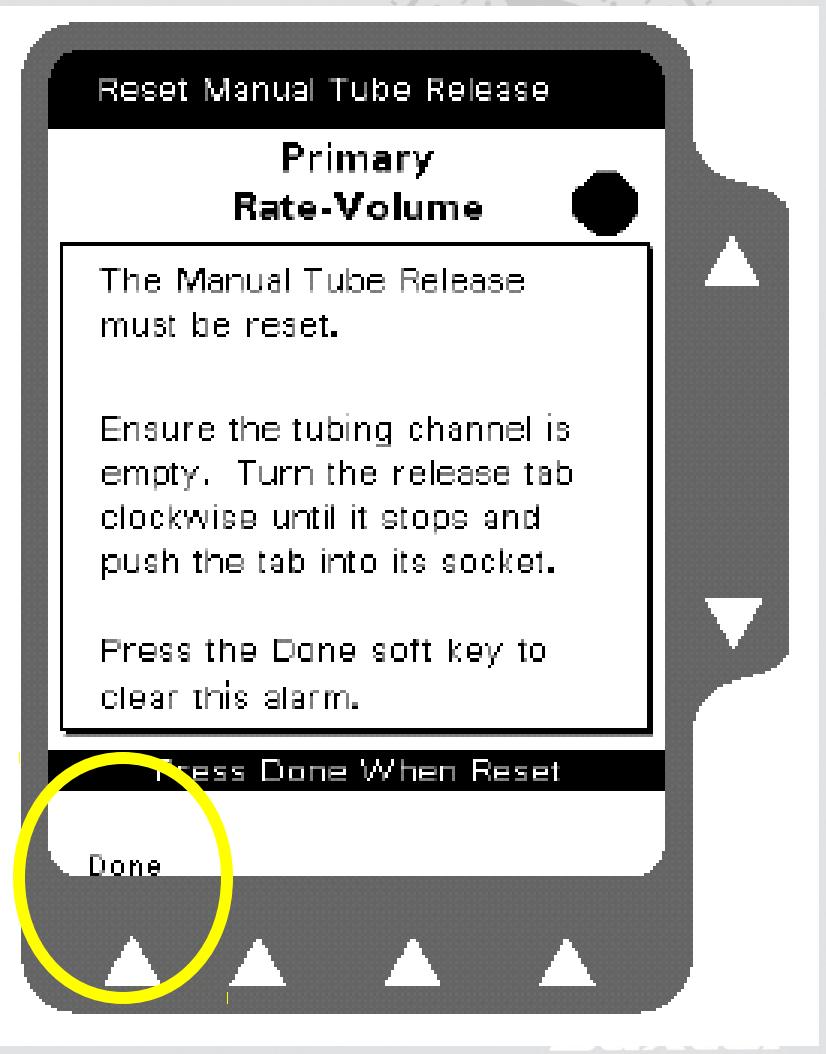


# The Manual Tube Release (MTR)



- To reset the Manual Tube Release
- Follow the instructions on the screen. Return the MTR to its HOME position and press the DONE softkey once complete.
- The pump will automatically return to the OFF state.
- **REMEMBER - IF THE PUMP WILL NOT TURN ON CHECK THE MTR.**

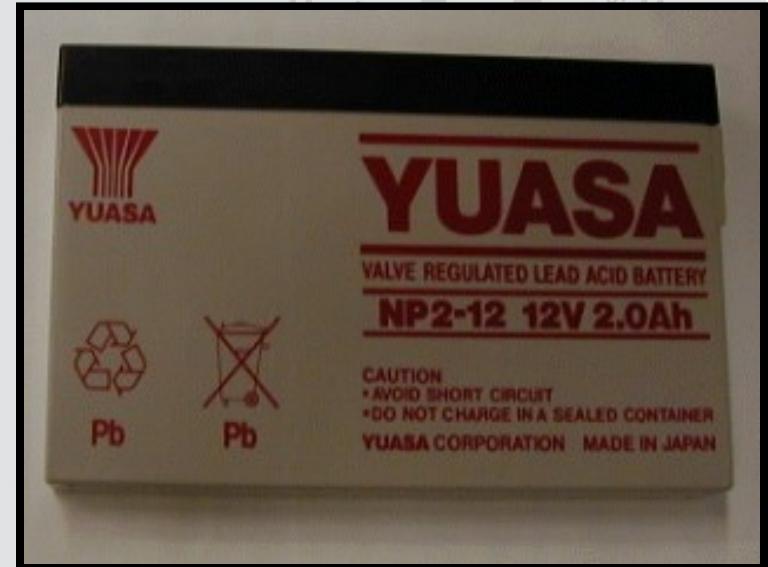
Done shows here



# The Battery



- The pump is equipped with internal batteries to power the pump during interruptions to mains power or if the patient and pump is being transported from one area to another.
- It is primarily designed as a Mains Powered device and should be connected to mains power at all times, whether in use or not.
- The design is such that no damage will occur to the battery if kept plugged in to mains all the time.
- A fully charged new battery will last for up to 7 hours but a battery perhaps up to a year old may run for  $2\frac{1}{2}$  hours.
- This is because batteries are a semi-consumable part of the Device and will 'wear' with normal usage. Therefore it makes good sense to keep the battery in a charged state.



# The Lithium Battery



- The Lithium battery provides back-up for the volatile memory with the device
- While the main battery powers the infusion the Lithium battery maintains the memory in the device such as Pump Personalities and Event History.
- It is a dual Lithium pack consisting of 2 x 3.6 volt cells.
- Typically the life of the Lithium is 4 to 5 years, however under certain circumstances this can be compromised.

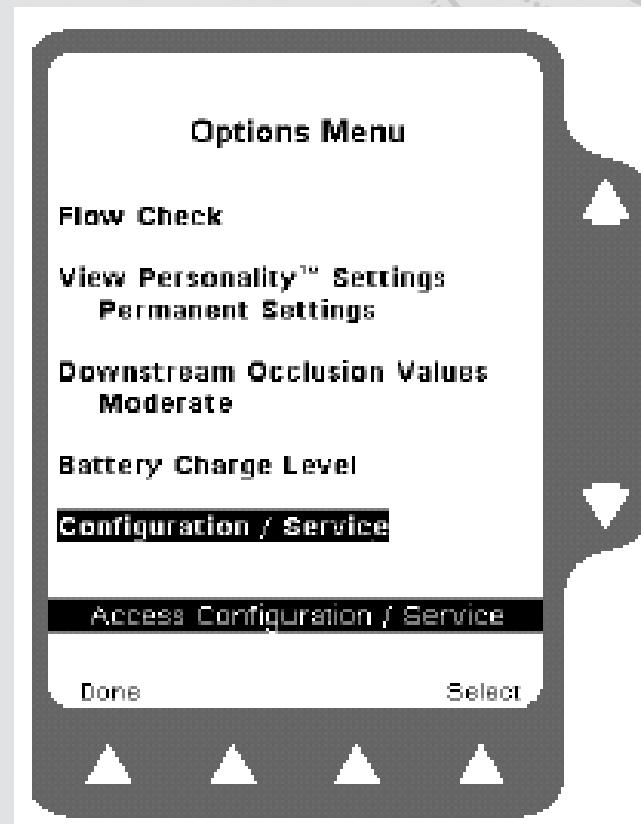
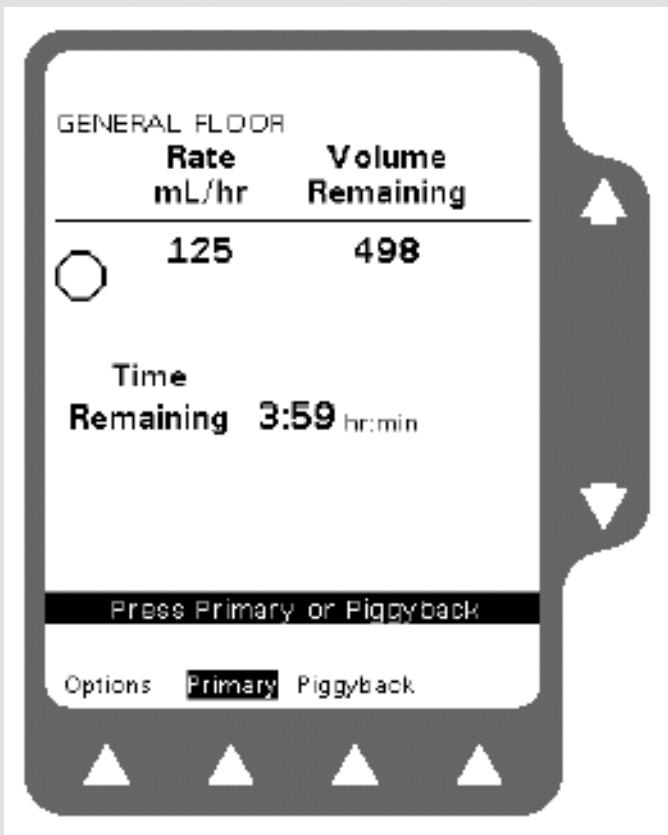


# The Configuration / Service Screen

RESPOND RESTORE RENEW



- From the MAIN SCREEN select Option (softkey 1) and select Configuration / Service.
- We will now review these option.



xter

RESPOND RESTORE RENEW

# The Configuration / Service Screen

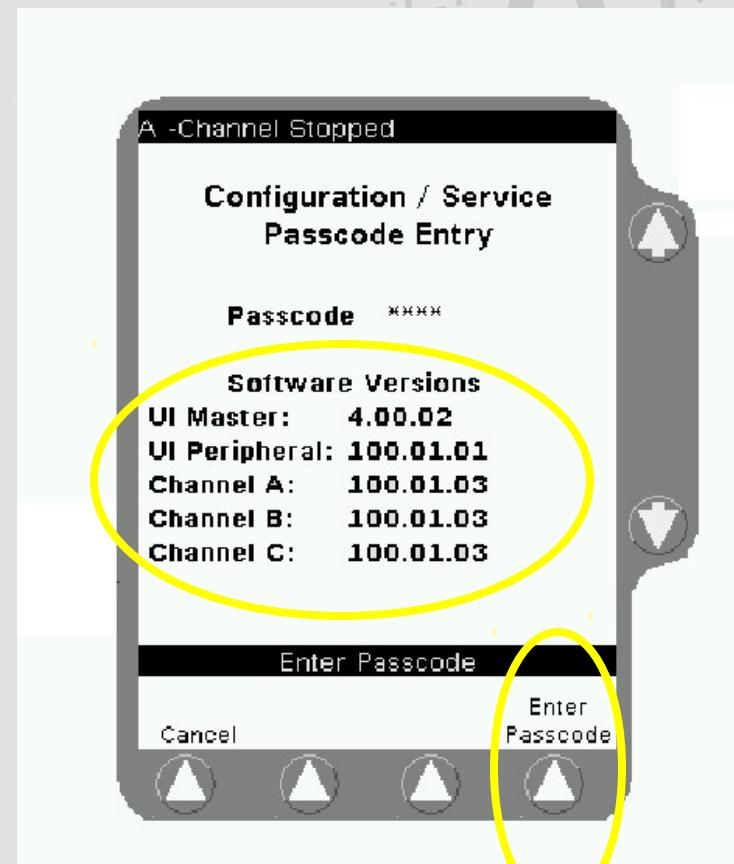


- Check Software Revision
- Enter the Passcode.

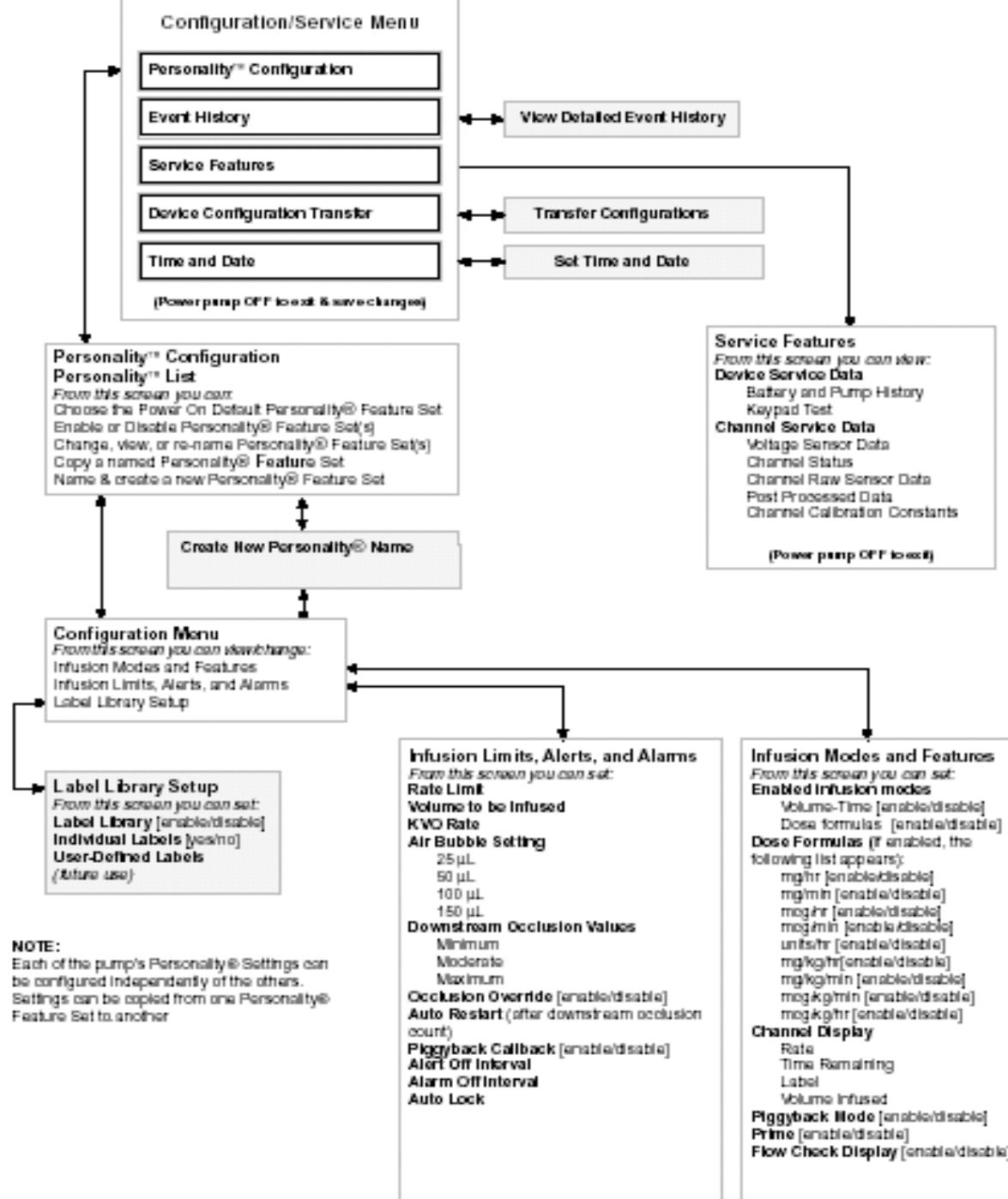
## Passcode Entry

**'8151'**  
**For C1 and C3.**

*It is recommended to not release this code for general circulation in the interests of device programming integrity.*



**Baxter**



# Pump Personalities



- The benefits of Pump Personalities is discussed in the movie.
- They allow the pump to be configured to match care areas within the hospital.
- There is one Permanent Settings Personality.
- Eight users definable Personalities which can be created in the pump.
- Once set into a pump the Personality Set can be transferred to other devices.
- The configuration defines the criteria for:
  - Infusion Modes & Features
  - Channel Display selection
  - Piggyback enable / disable
  - Infusion limits & alarms
  - Label Library
  - Prime enable / disable

# Pump Personalities

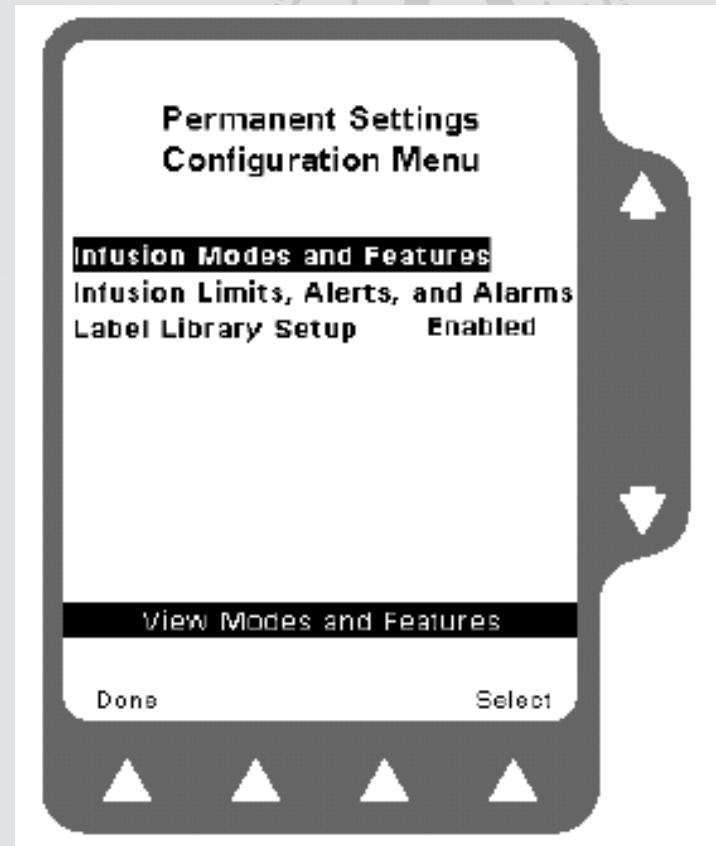
- Selections with the Personality Sets:

RESPOND RESTORE RENEW



- Infusion Modes & Features:
  - Rate/Volume, Volume/Time, Dose Mode, Dose/Patient Weight
- Channel Display selection:
  - Rate, Volume Infused, Time Remaining, Label
- Piggyback enable / disable
  - Allows the delivery of primary and secondary medication
- Infusion limits & alarms
  - Allows limits to be tailored hence reducing the risk to the patient
- Label Library
  - 64 defined labels + 32 user definable labels

**ALWAYS START WITH THE CUSTOM LABEL LIST**
- Prime enable / disable
- To create a Pump Personality, you must first name it and then go through the above settings.



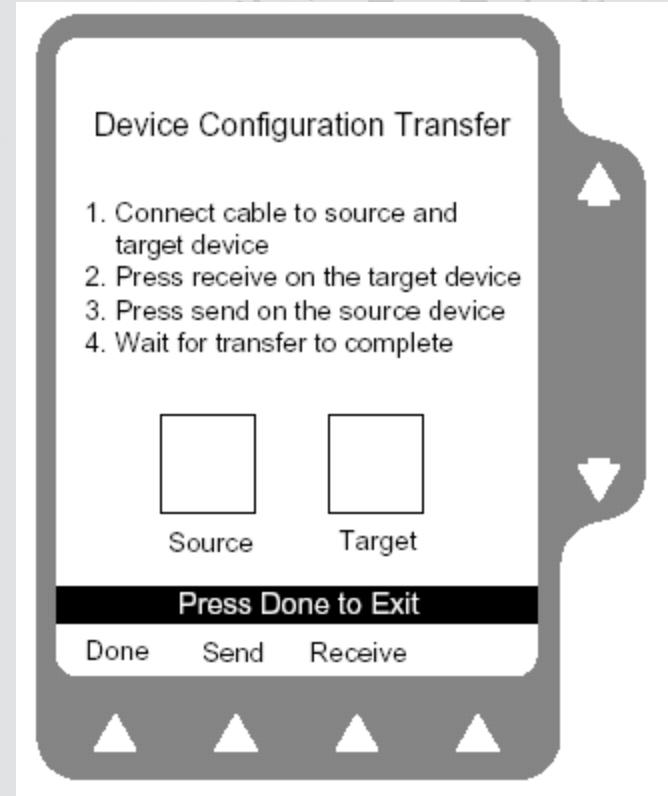
**Create YOUR New Pump Personality!!**

**Baxter**

# Personality Transfer



- **Transferring a Personality from one device to another.**
- **In the Configuration / Service menu select 'Device Configuration Transfer'.**
- **Connect the two pumps using the configuration transfer cable.**
- **Press 'Send' on the Source Pump (the device with the personalities to be transferred) and Receive on the Target Pump.**
- **Press Confirm on both pumps and Transfer will commence.**
- **It will count from 0 -100 as the transfer runs.**
- **All Personalities existing in the Target pump will be over-written.**



# Event History

RESPOND RESTORE RENEW



- Colleague contains an event recorder which records details of infusions, the pumps actions, all key strokes, infusion alarms and alerts and internal alarms.
- This is helpful in identifying situations which lead to difficulty for the user.
- 1000 events are recorded.
- Each event is date & time stamped.
- Events cannot be erased from memory.

**Event History - Detailed**

Top Event #1 03/02/98 14:03:38

SOFTKEY #4 press	03/02 14:03
ARROW DOWN press	03/02 14:03
ARROW DOWN press	03/02 14:03
SOFTKEY #4 press	03/02 14:03
SOFTKEY #4 press	03/02 14:03
Battery charging stop	03/02 14:03
Battery charging start	03/02 14:04
OFF press	03/02 16:47
A Channel module power off	03/02 16:47
Base unit power off	03/02 16:47
Five-Hour Memory AutoClear	03/03 10:05
Base unit power on	03/03 10:05
Personality™ Selected: 1	03/03 10:05
A Channel module power on	03/03 10:05
SOFTKEY #1 press	03.03 10:05

Bottom Event: #15 03/03/98 10:05:53

**Use Soft Keys to Scroll**

Done	Page Down	Most Recent
------	-----------	-------------

▲ ▲ ▲ ▲

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# Service Features - Battery and Pump History

**Configuration/Service Menu**

- Personality™ Configuration
- Event History
- Service Features**
- Device Configuration Transfer
- Time and Date

(Power pump OFF to exit & save changes)

**Service Features**

From this screen you can view:

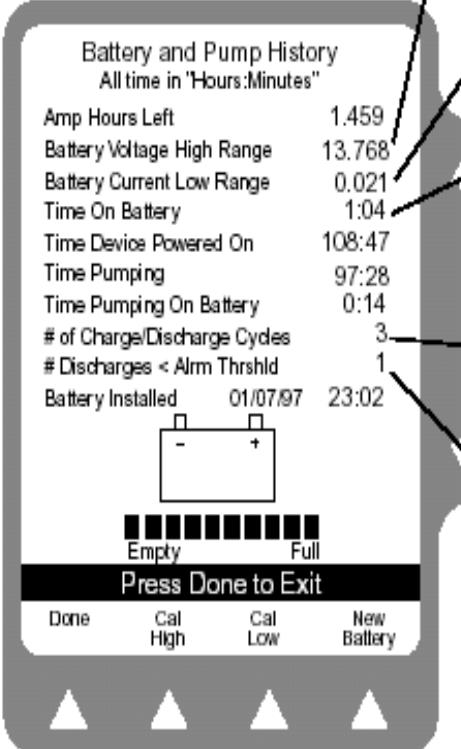
**Device Service Data**

- Battery and Pump History
- Keypad Test

**Channel Service Data**

- Voltage Sensor Data
- Channel Status
- Channel Raw Sensor Data
- Post Processed Data
- Channel Calibration Constants

(Power pump OFF to exit)



The image shows a screenshot of the 'Battery and Pump History' screen. The screen displays various metrics and a battery status indicator. The metrics include: Amp Hours Left (1.459), Battery Voltage High Range (13.768), Battery Current Low Range (0.021), Time On Battery (1:04), Time Device Powered On (108:47), Time Pumping (97:28), Time Pumping On Battery (0:14), # of Charge/Discharge Cycles (3), # Discharges < Alm Threshld (1), and Battery Installed (01/07/97). Below these metrics is a battery icon with a scale bar from 'Empty' to 'Full'. The scale bar is mostly empty with a few black segments. The text 'Press Done to Exit' is at the bottom, followed by four white triangle buttons. Callouts from the right side point to specific data points on the screen:

- BATTERY VOLTAGE HIGH RANGE:** Points to the 'Battery Voltage High Range' value of 13.768.
- FULL CHARGE:** Points to the 'Battery Current Low Range' value of 0.021.
- TIME ON BATTERY POWER:** Points to the 'Time On Battery' value of 1:04.
- BATTERY CYCLING:** Points to the '# of Charge/Discharge Cycles' value of 3.
- POTENTIAL DAMAGE:** Points to the '# Discharges < Alm Threshld' value of 1.

# Service Features - Voltage Sensor Data



## Configuration/Service Menu

Personality™ Configuration

Event History

Service Features

Device Configuration Transfer

Time and Date

(Power pump OFF to exit & save changes)

## Service Features

From this screen you can view:

### Device Service Data

Battery and Pump History

Keypad Test

### Channel Service Data

Voltage Sensor Data

Channel Status

Channel Raw Sensor Data

Post Processed Data

Channel Calibration Constants

(Power pump OFF to exit)

## Voltage Sensor Data

Channel Supply Voltage	12.224
Vkey Voltage	5.038
Vmas Voltage	5.001
Lithium Battery Voltage	7.449
Vslv Voltage	5.052
Coarse Voltage	12.087
Vaudio Voltage	3.665

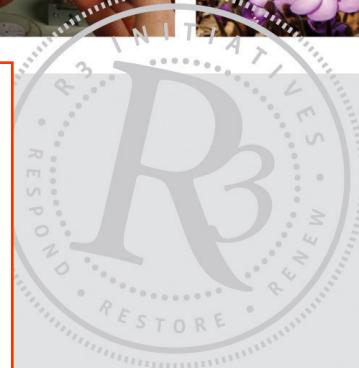
Press Done to Exit

Done Test Tone Buzzer Nurse  
On On On Call On



**Baxter**

# Service Features



## Configuration/Service Menu

Personality™ Configuration

Event History

Service Features

Device Configuration Transfer

Time and Date

(Power pump OFF to exit & save changes)

## Service Features

From this screen you can view:

### Device Service Data

Battery and Pump History

Keypad Test

### Channel Service Data

Voltage Sensor Data

Channel Status

Channel Raw Sensor Data

Post Processed Data

Channel Calibration Constants

(Power pump OFF to exit)

## Voltage Sensor Data

Channel Supply Voltage	12.224
Vkey Voltage	5.038
Vmas Voltage	5.001
Lithium Battery Voltage	7.449
Vslv Voltage	5.052
Coarse Voltage	12.087
Vaudio Voltage	3.665

Voltage	Range
Channel Supply	12.581 to 15.204 VDC
Vkey	4.5 to 5.5 VDC
Vmas	4.5 to 5.5 VDC
Lithium battery	7.00 to 7.60 VDC
Vslv	4.5 to 5.5 VDC
Coarse Voltage	13.5 to 14.2 VDC
Vaudio	0.4 to 5.0 VDC

# Service Features - Air In Line Sensor Check

**Configuration/Service Menu**

- Personality™ Configuration
- Event History
- Service Features**
- Device Configuration Transfer
- Time and Date

(Power pump OFF to exit & save changes)

**Service Features**

From this screen you can view:

**Device Service Data**

- Battery and Pump History
- Keypad Test

**Channel Service Data**

- Voltage Sensor Data
- Channel Status
- Channel Raw Sensor Data**
- Post Processed Data
- Channel Calibration Constants

(Power pump OFF to exit)

**Channel Raw Sensor Data**

Pressure Sensors:

Upstream: 79	Downstream: 45
--------------	----------------

Valve Positions:

Upstream: 184	Downstream: 187
---------------	-----------------

Slide Clamps:

Forward: 255	Rear: 255
--------------	-----------

Temperature (in degrees C)

Temp #1: 31.1	Temp #2: 30.3
---------------	---------------

Tube Present:

Upstream: 0	Downstream: 0
-------------	---------------

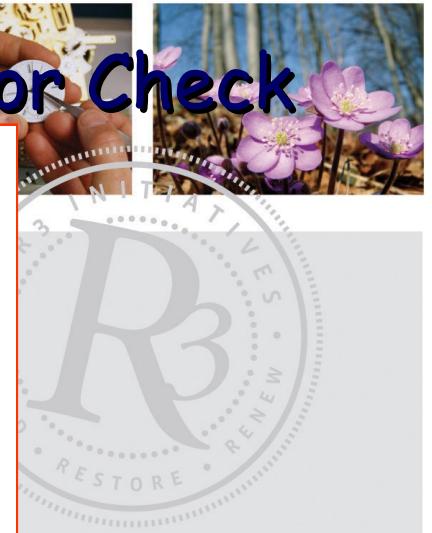
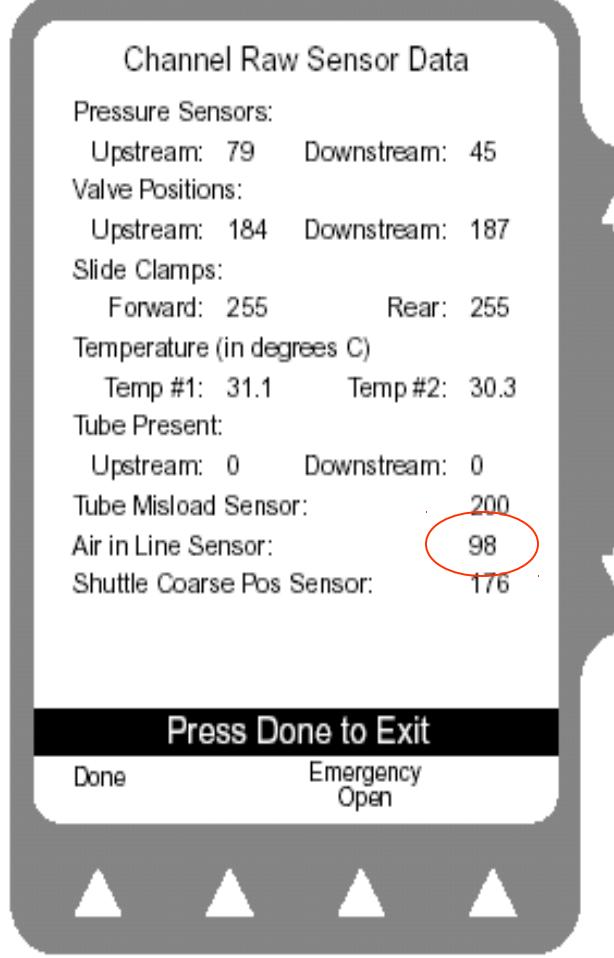
Tube Misload Sensor: 200

Air in Line Sensor: **98**

Shuttle Coarse Pos Sensor: 176

Press Done to Exit

Done      Emergency Open



**Baxter**

# Service Features - Air In Line Sensor Check

Configuration/Service Menu

- Personality™ Configuration
- Event History
- Service Features
- Device Configuration Transfer
- Time and Date

(Power pump OFF to exit & save changes)

Channel Raw Sensor Data

Pressure Sensors:

Upstream: 79	Downstream: 45
--------------	----------------

Valve Positions:

Upstream: 184	Downstream: 187
---------------	-----------------

Slide Clamps:

Forward: 255	Rear: 255
--------------	-----------

Temperature (in degrees C)

Temp #1: 31.1	Temp #2: 30.3
---------------	---------------

Tube Present:

Upstream: 0	Downstream: 0
-------------	---------------

Tube Misload Sensor: 200

Air in Line Sensor: 98

Shuttle Coarse Pos Sensor: 176



## Service Features

From this screen you can

### Device Service Data

Battery and Pump His  
Keypad Test

### Channel Service Data

Voltage Sensor Data

Channel Status

Channel Raw Sensor

Post Processed Data

### Channel Calibration C

(Power pump OFF to

1. Access the Service Features screen.
2. Select Channel Raw Sensor Data.
3. Load an air-filled tubing segment into the pump and wait for the display to show STOPPED.
4. Record the highest Air in Line sensor value on the data sheet. It should be  $\leq 128$ .
5. Load a fluid-filled tubing segment into the pump and wait for the pump to display STOPPED. **Immediately** observe and record the lowest Air in Line sensor value. Verify that the value is  $\geq 187$  and  $\leq 243$ .

# Service Features - Prism Check

## Configuration/Service Menu

Personality™ Configuration

Event History

Service Features

Device Configuration Transfer

Time and Date

(Power pump OFF to exit & save changes)

## Service Features

From this screen you can view:

### Device Service Data

Battery and Pump History

Keypad Test

### Channel Service Data

Voltage Sensor Data

Channel Status

Channel Raw Sensor Data

Post Processed Data

Channel Calibration Constants

(Power pump OFF to exit)

### Channel Raw Sensor Data

#### Pressure Sensors:

Upstream: 79      Downstream: 45

#### Valve Positions:

Upstream: 184      Downstream: 187

#### Slide Clamps:

Forward: 255      Rear: 255

#### Temperature (in degrees C)

Temp #1: 31.1      Temp #2: 30.3

#### Tube Present:

Upstream: 0      Downstream: 0

#### Tube Misload Sensor:

200

#### Air in Line Sensor:

98

#### Shuttle Coarse Pos Sensor:

176

Press Done to Exit

Done

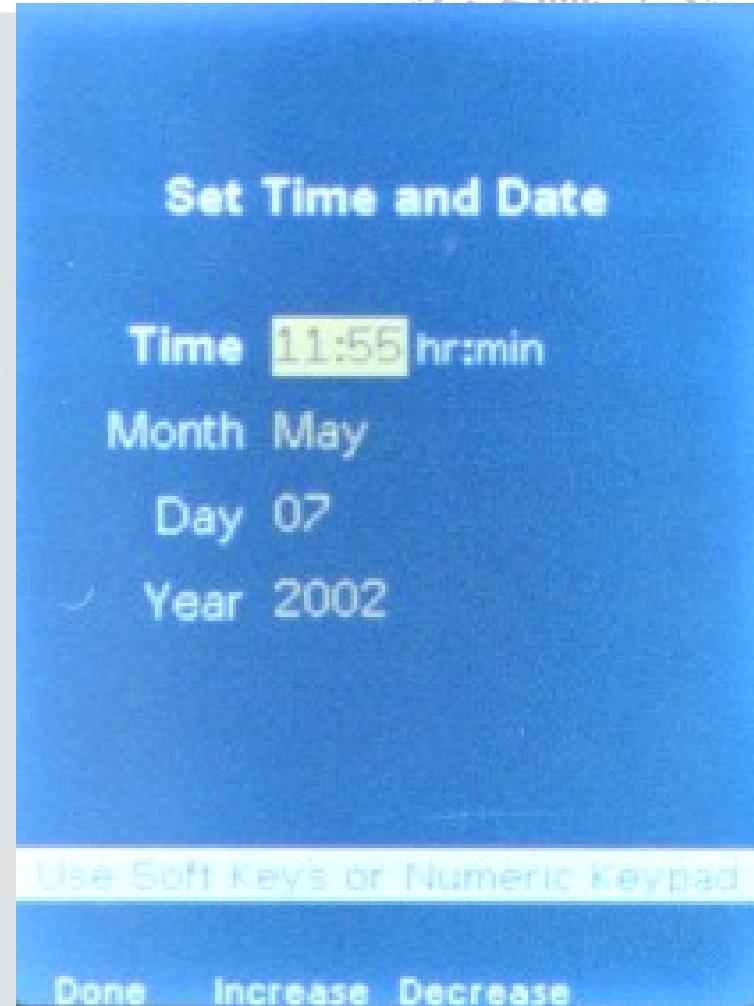
Emergency  
Open

**Baxter**

# Time and Date



- Colleague does not automatically set Day Light Savings Time.
- Date and Time do not transfer over



**Baxter**



# Routine maintenance

- Chapter 6-1 Routine Maintenance
- Chapter 6-3 Cleaning
  - Exterior
  - Tubing Channel
  - Refer to Operators Manual, chapter 7 addendum for tested cleaning materials.
- Chapter 6-4 Battery Maintenance
- Chapter 6-8 Storage
- Refer to new service bulletins

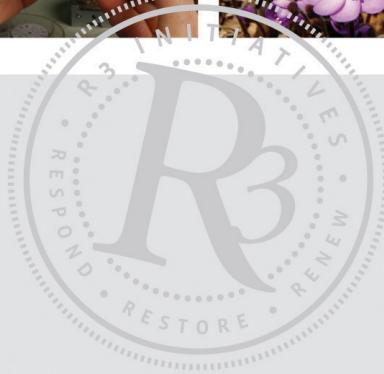


RESPOND RESTORE RENEW



# Service Bulletins

- Colleague "On/Off" Key cover.
- Preventative Maintenance.
- Keypad Insulator.
- Battery Connector Harness
- Technical Service Bulletins will be sent to all the Baxter approved Colleague Service Centers. **Baxter**



# Troubleshooting

- Operational ‘Context’.
- Methods
  - Alerts
  - Alarms
  - Failure messages displays
  - Symptoms
  - Event History
  - ‘Reset-able’ Failure Codes (\*)
  - Failure with no Keypad Response

**(Note: Always Troubleshoot with a fully charged battery)**

**Baxter**



# Troubleshooting cont

- Code ranges
  - 0-196 Internal Software
  - 198 Memory chip incompatibility
  - 199 Memory/battery
  - 200 to 399 hardware diagnostic/UIM or soft
  - 400-499 Slave related reported by master Software
  - 500-699 Slave related reported by slave Software
  - 700-799 Communication problems with PHM
  - 800-899 PHM failures reported by PHM



# Removal and Replacement

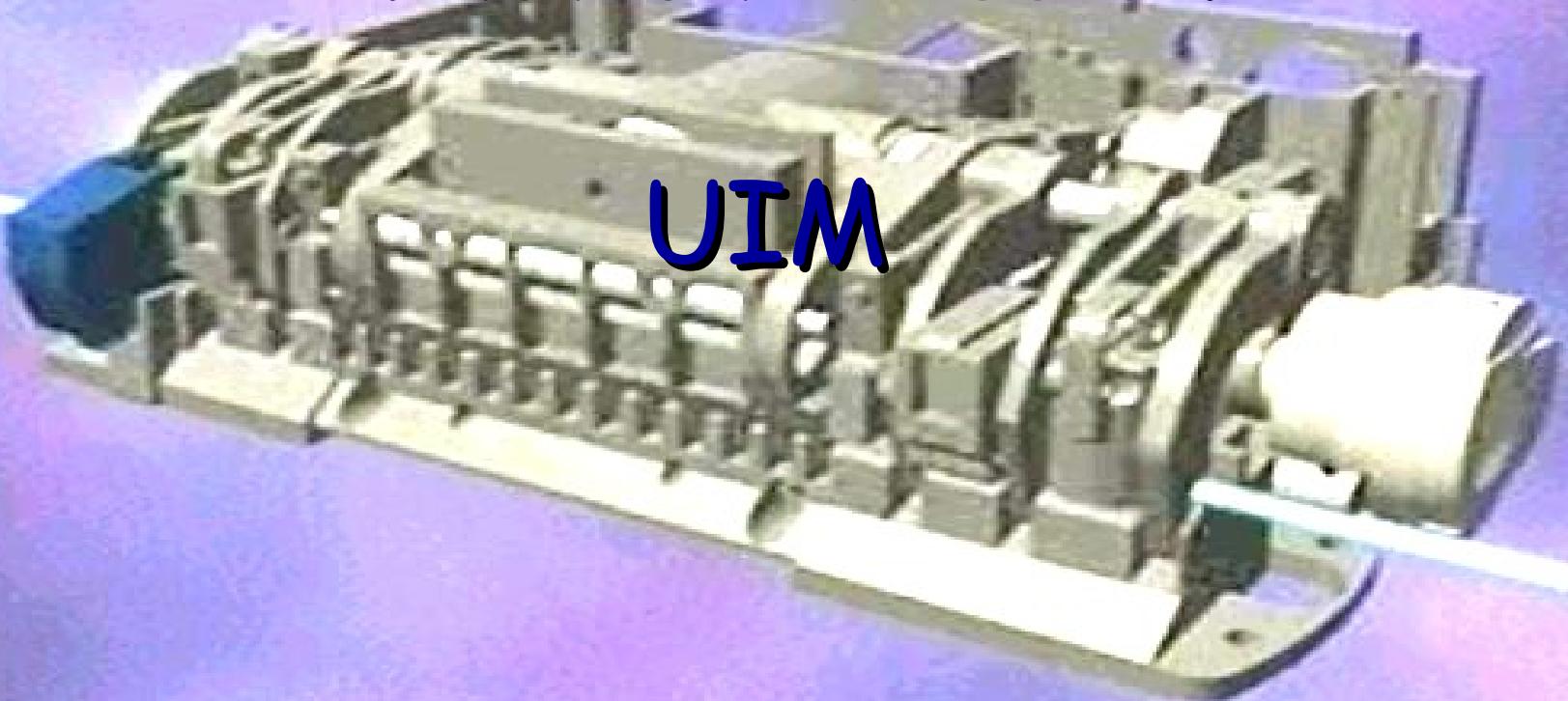
- Refer to Chapter 8 of the service manual
  - Tools 8-2
  - Torque 8-4
  - Post Repair Testing and Inspection 8-7
  - If any calibration is required refer to Chapter 9

RESPOND RESTORE RENEW



# Practical Session

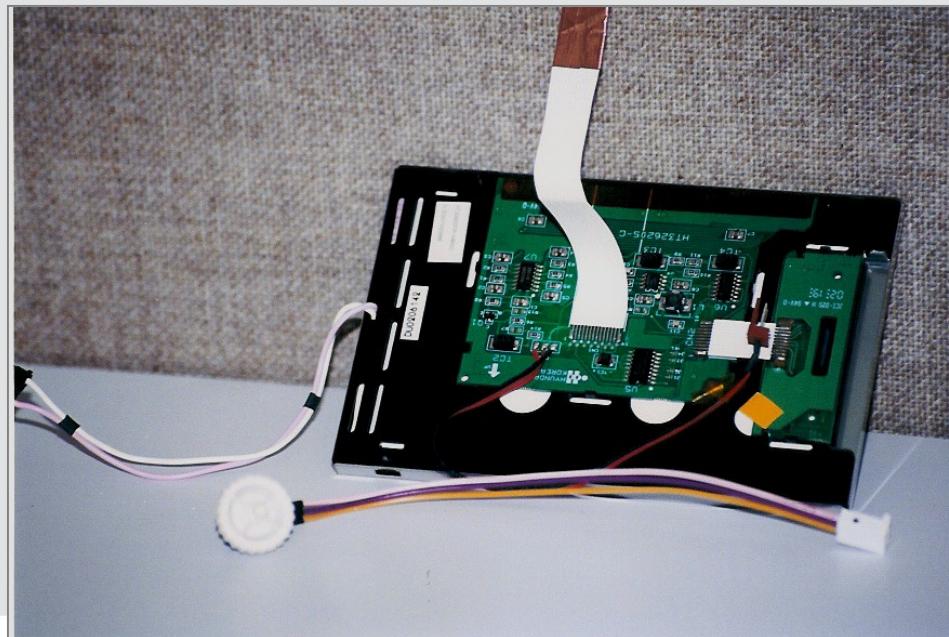
**UIM**





# Removal and replacement of Alternate UIM LCD 8-16

- LCD (longer Contrast Harness required.)

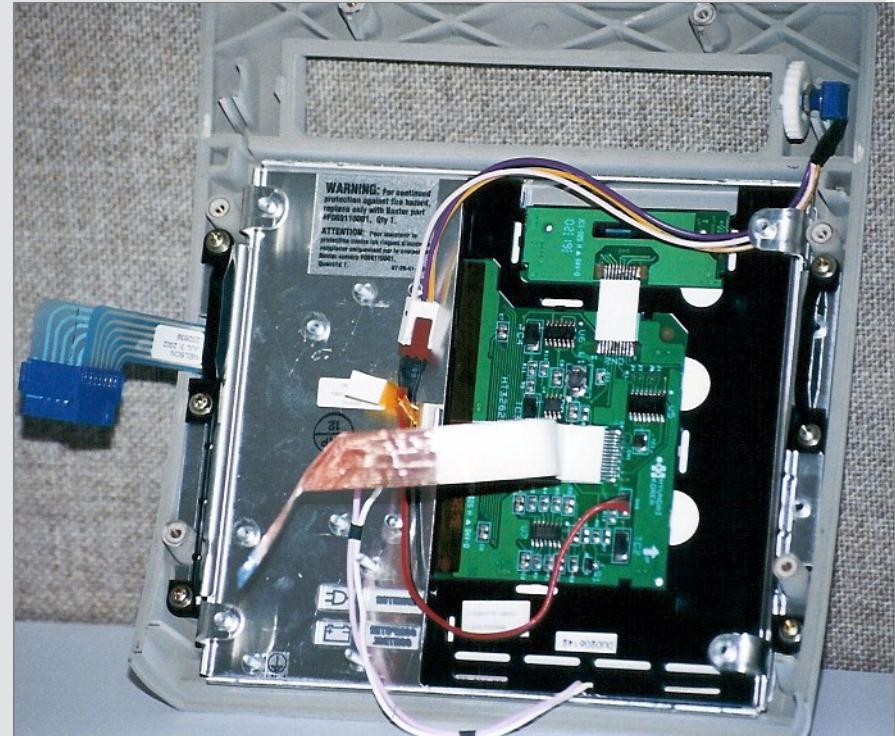


**Baxter**



# Alternate UIM LCD cont.

- Critical Issues when upgrading
  - Wire routing
  - Display placement





# AC Cord Retainer

## 8-30 part of power cord replacement.



- Slotted bottom Hole to allow easier removal of AC power cord.
- Must use screw part number 4009330115 for lower screw.

*Baxter*

RESPOND RESTORE RENEW



# Power Supply

Condor PSU in  
later C1 and  
all CX3's



Aztec PSU  
in early  
C1's.

*Baxter*



# Power Supply (cont.)

- Aztec PSU is Obsolete.**

When upgrading from Aztec PSU, the Shield will also requiring changing .





# Pump Modules 8-60

- **Shuttle motor 8-69**
- **Tube loading motor inspection and tightening to investigate 803:02, 803:03, and 803:09. 8-78.**
- **AIL 8-89.**
- **Slide clamp prisms 8-94 to investigate 803:07, 865:01, 865:19 or 896:01**



# Shuttle Gear Box

- **Workshop Replacement Only**
  - Cleaning.
  - Testing Requirements
  - Baxter Approved Service Center.

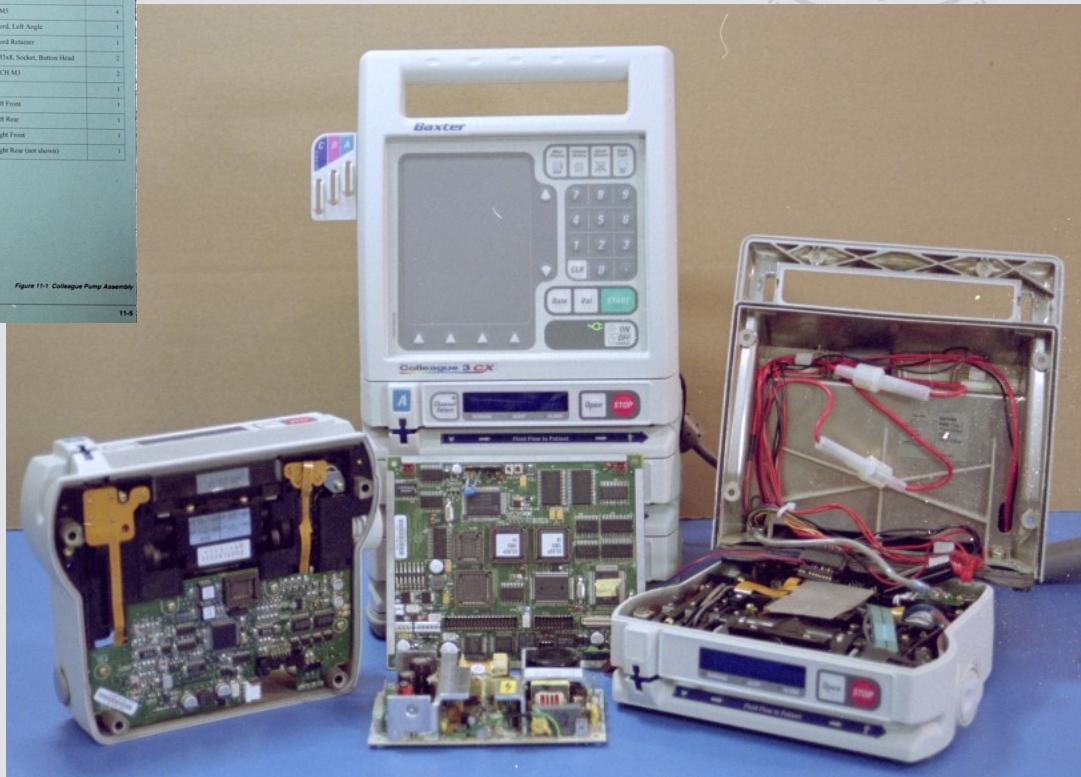
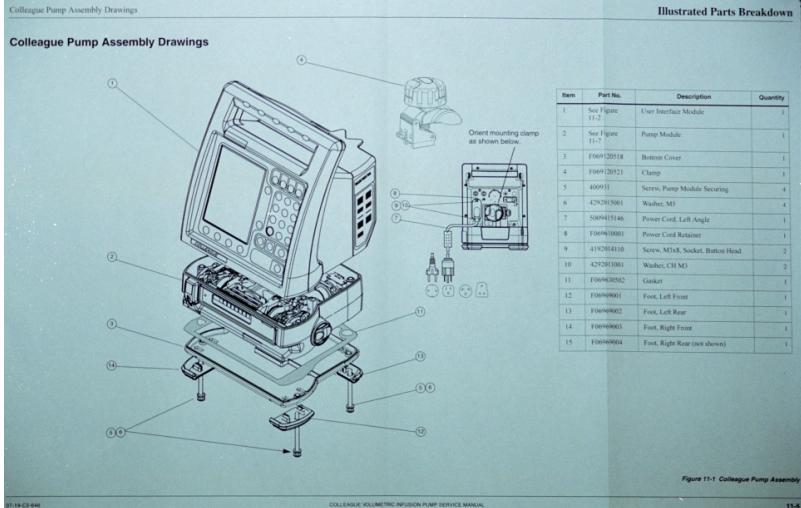


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# Parts



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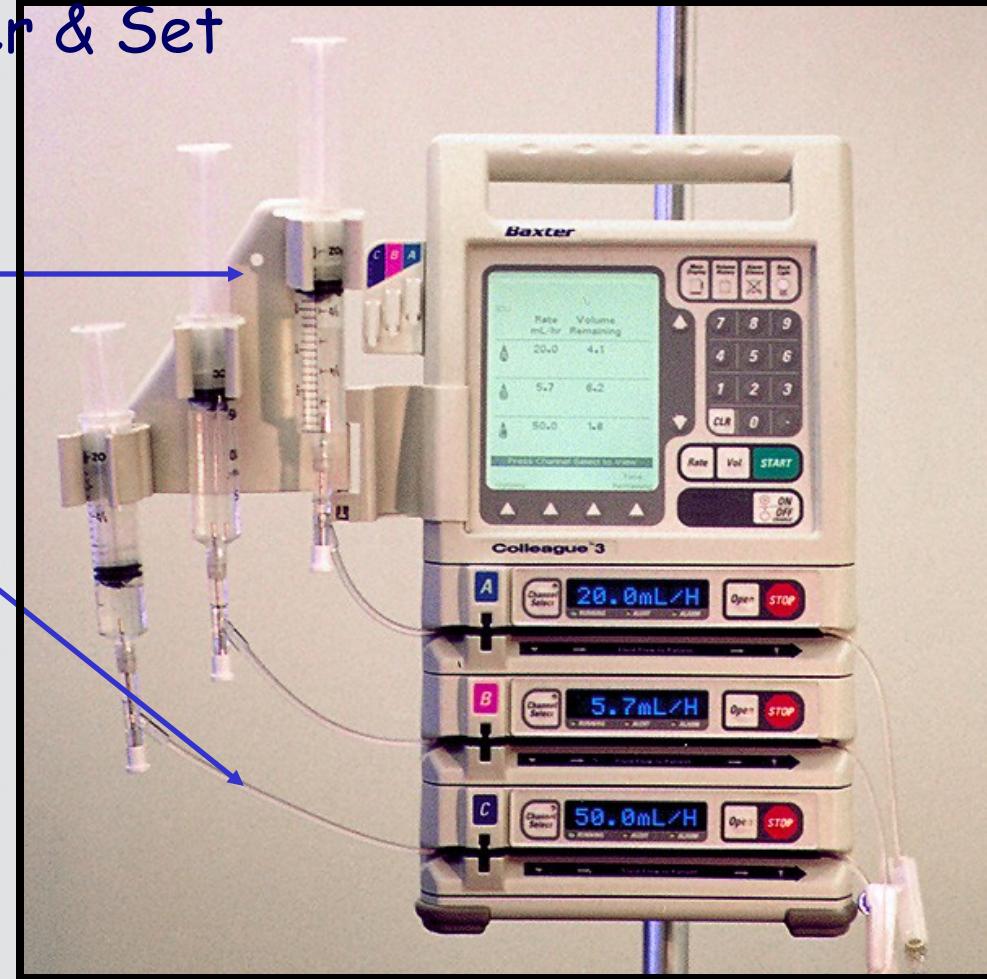
RESPOND RESTORE RENEW



## Colleague Syringe Holder & Set

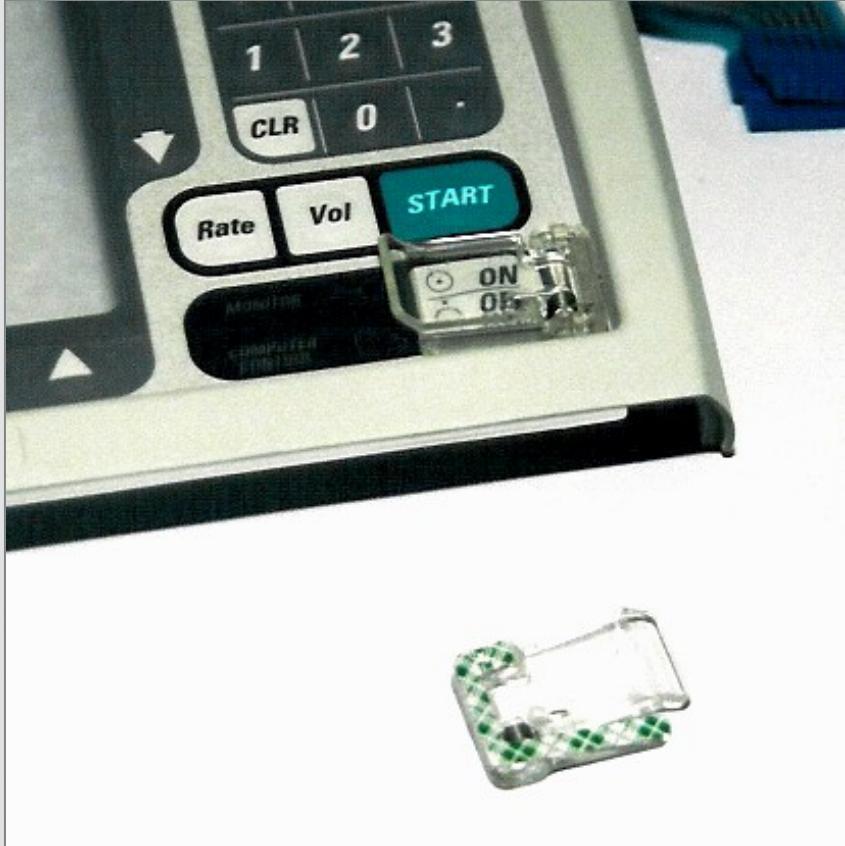
Syringe Holder

Syringe Set



**Baxter**

RESPOND RESTORE RENEW



# On/Off charge Key cover

07-27-01-671

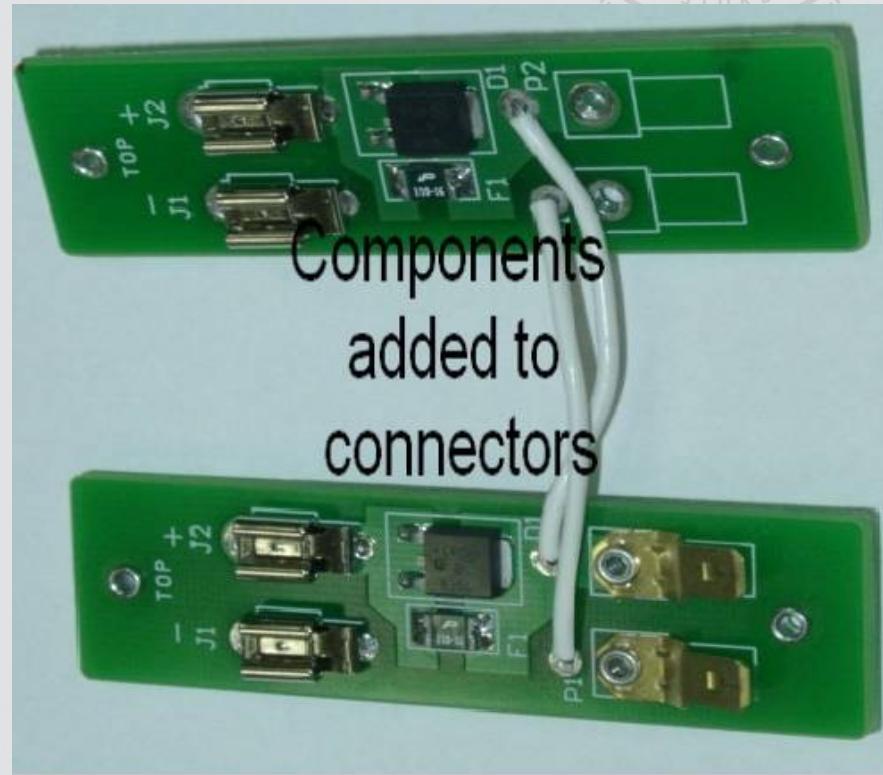
- Prevents an operator from turning on or off the pump inadvertently

*Roxter*

RESPOND RESTORE RENEW



# Revised Battery Connector Harness



*baxter*



# Preventive Maintenance

## Document - 17-32-11-050

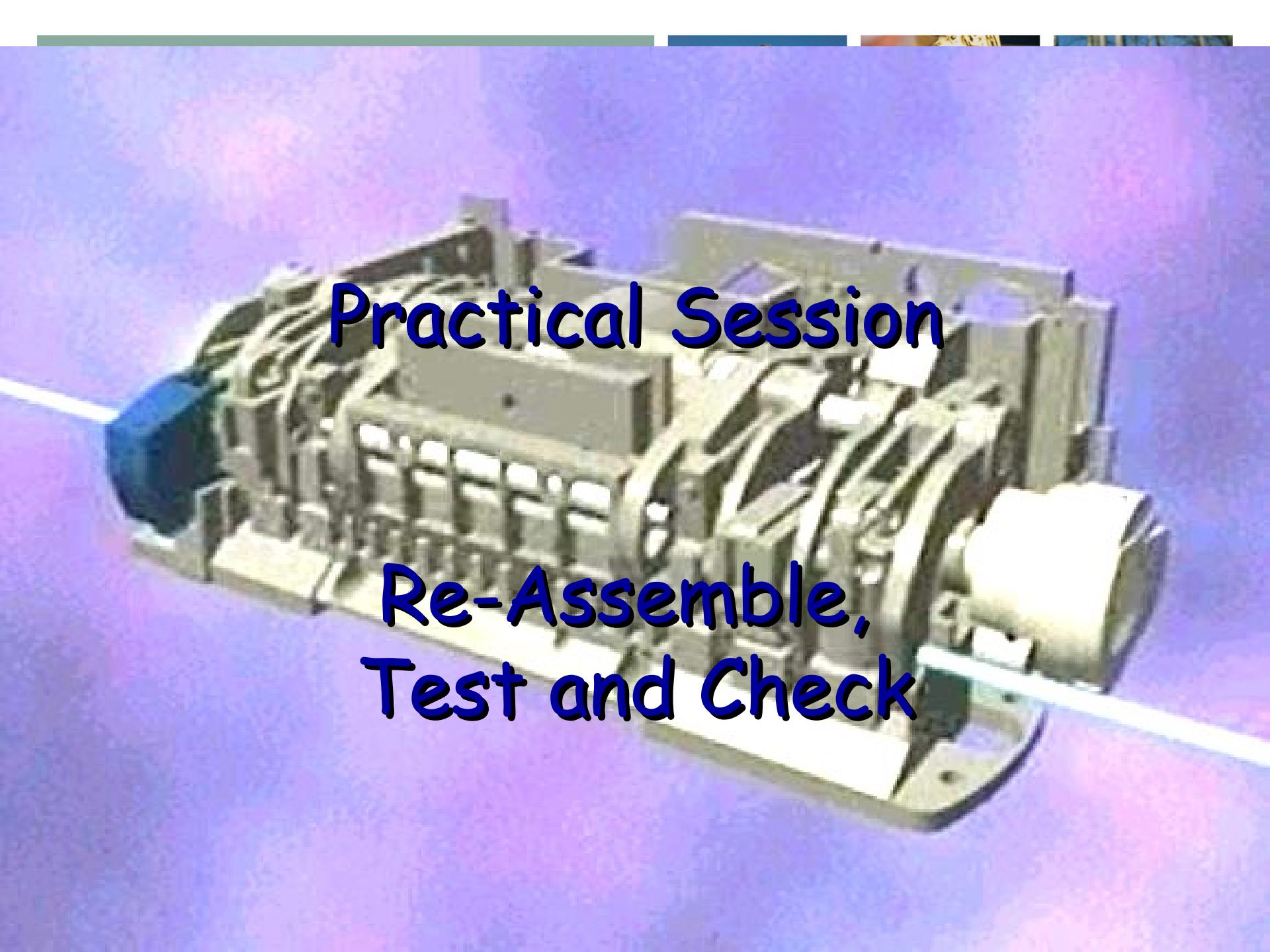
- Sets the standards to accomplish an Post repair functional test and verification.
- Technical Data Sheet to document and record test Data for the post Repair procedure.



# Preventive Maintenance

## Document - 07-27-49-378

- Standard Operating Procedures for recent recall Action
- Provides a Technical Data Sheet to document Upgrade events and Functional Testing.



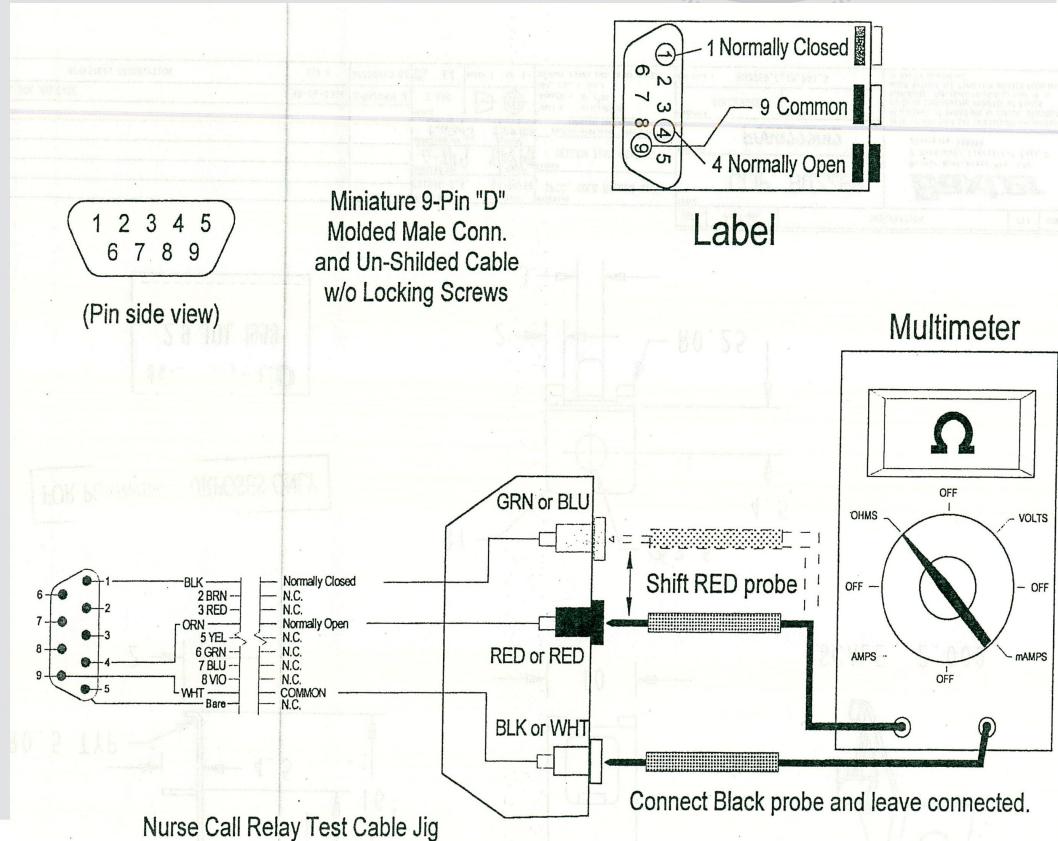
# Practical Session

## Re-Assemble, Test and Check

RESPOND RESTORE RENEW



# Voltage Sensor Data Nurses Call





# Functional Test - AIL Pressure Test

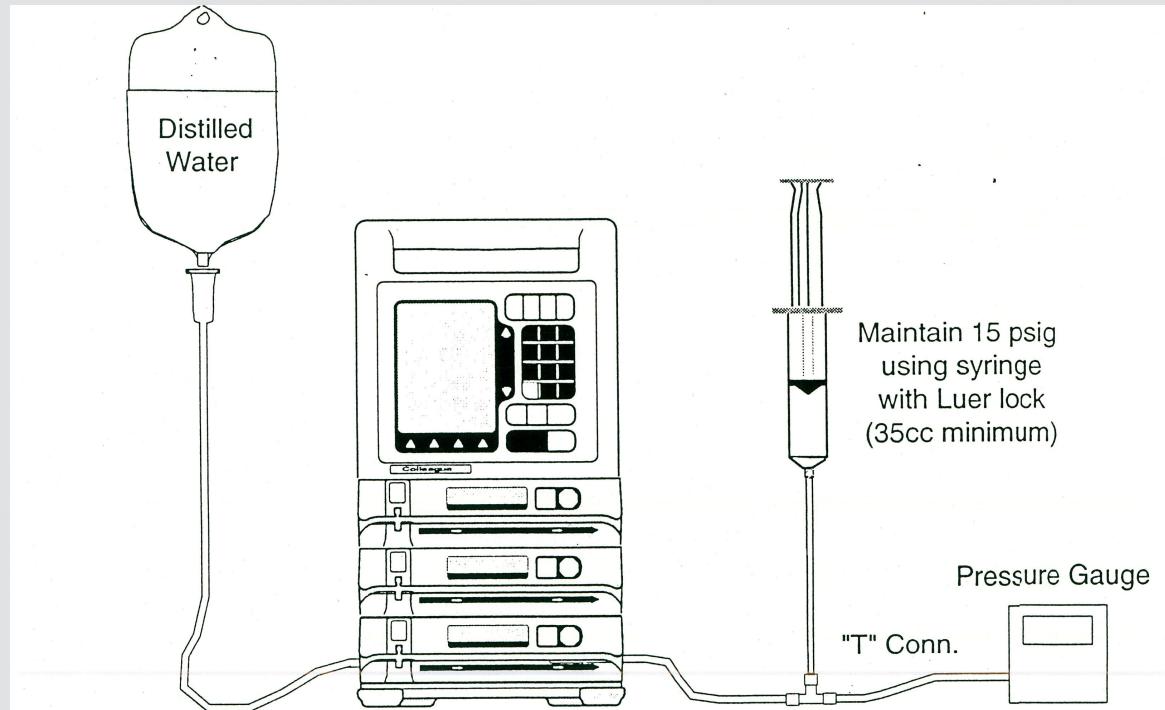
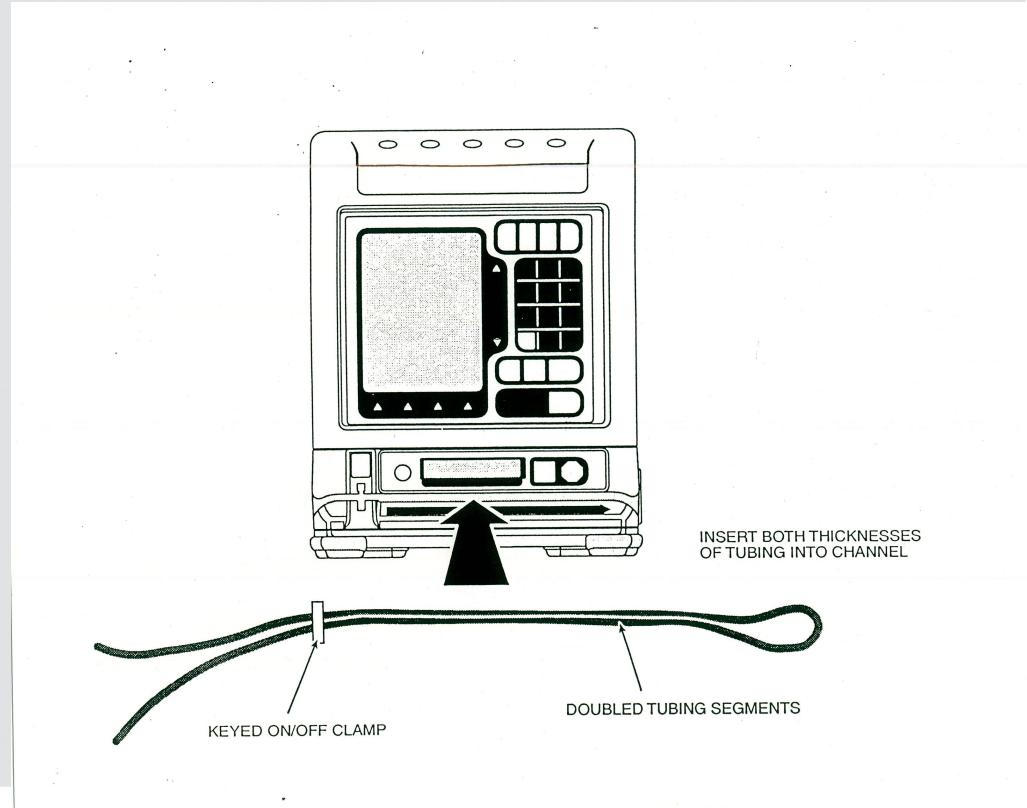


Figure 10-2 Air In Line Test

RESPOND RESTORE RENEW



# Functional Test- Tube Mis-load Test



RESPOND RESTORE RENEW



# Functional Test

## Occlusion Pressure Testing

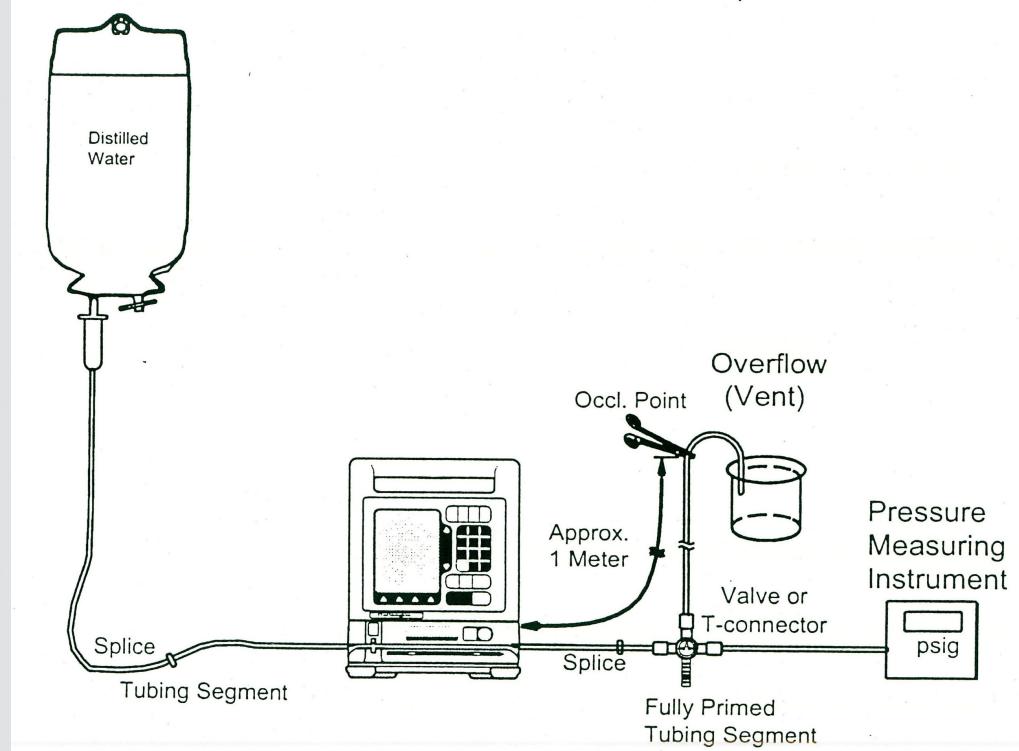


Figure 10-4 Pressure Test Setup



# Channel Raw Sensor Data

**Channel Raw Sensor Data**

**Pressure Sensors:**  
Upstream: 172 Downstream: 20

**Valve Positions:**  
Upstream: 146 Downstream: 141

**Slide Clamps:**  
Forward: 255 Rear: 255

**Temperature (in degrees C)**  
Temp #1: 25.0 Temp #2: 24.8

**Tube Present:**  
Upstream: 1 Downstream: 1

**Tube Misload Sensor:** 171

**Air In Line Sensor:** 224

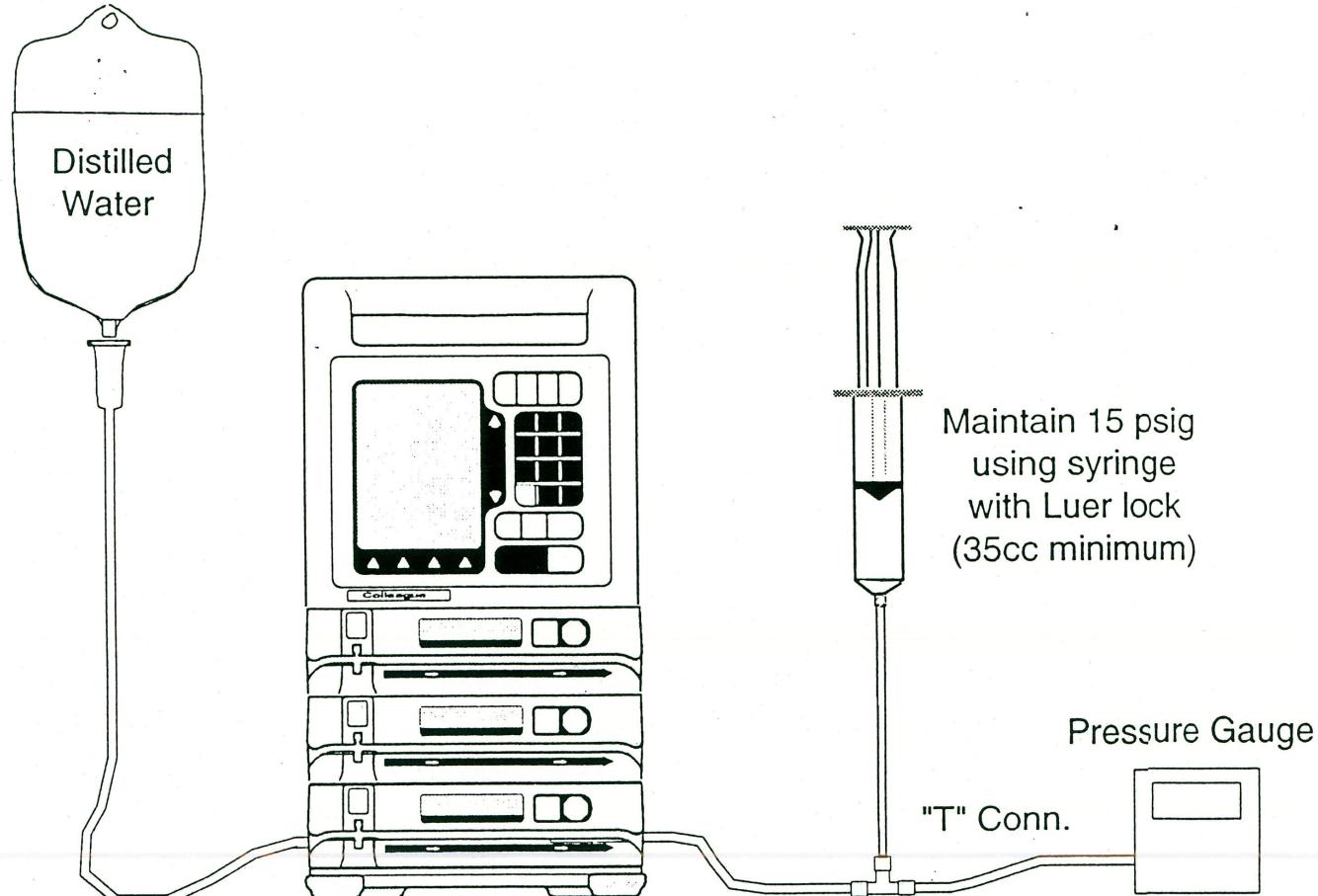
**Shuttle Coarse Pos Sensor:** 149

Press Done to Exit

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# Channel Raw Sensor Data

RESPOND RESTORE RENEW



*Figure 10-2 Air In Line Test*

**Baxter**



# Colleague CX 5.00 and Higher

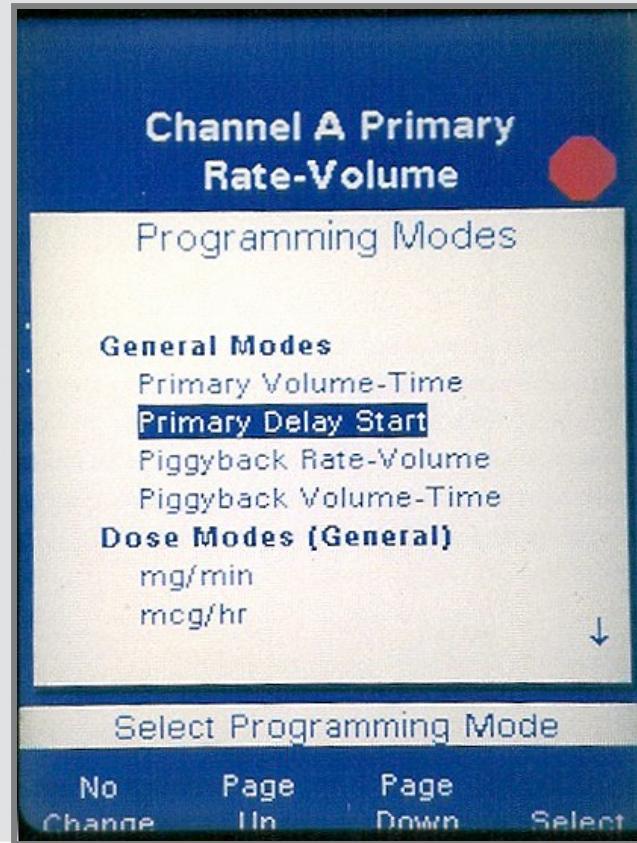


- **Delay Start**
- **Service personnel only**
  - Enabled or disabled via Infusion modes
  - Used for Primary infusions only
  - 24 hour format
  - Operator selects through Change Modes
  - Sets time and Date
  - A rate and volume have to be selected
  - Watch and Stop sign icons
  - Once started options



# Delay Start

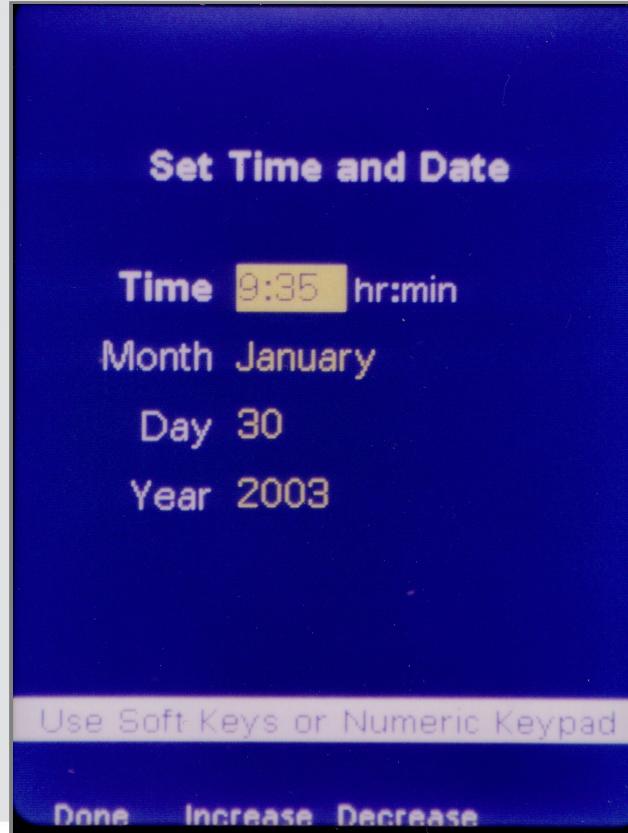
- **Change mode**
- **Primary delay start**
- **Select**





# Delay start cont.

- Set or verify correct time in 24hr format
- Volume history will be cleared
- Soft key set
- Press done

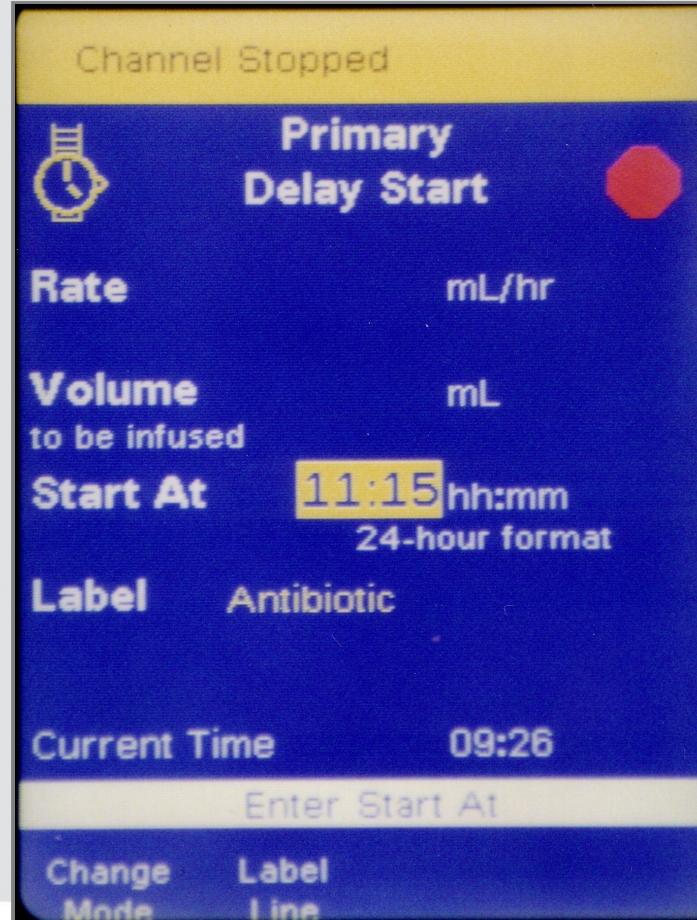


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# Delay start cont.

- Programmed delayed start
- Stop sign icon
- Start time 16:30
- Current time 14:12
- Press Start to confirm





# Delay Start cont.

- Awaiting start.
- Press start a second time.



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# Guardian Installation



- Refer to Installation Guide.
- Error code #198 after replacing software at next Power-On.
- Verification after installation of the Guardian software
- Global Guardian Software Version 5.04



# Guardian Features



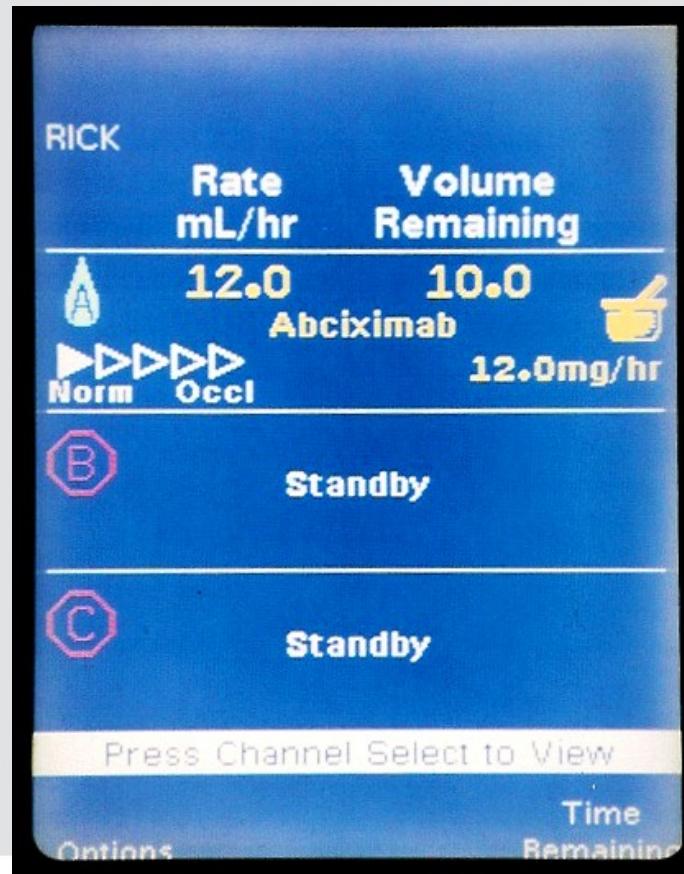
- Authorized personnel configure limits
- Authorized personnel enable or disable labels independently, for each personality
- Can be overridden if error found or therapy dictates.
- Available for Primary infusion only
- Mortar and Pestle icon

RESPOND RESTORE RENEW



# Guardian Cont

- Guardian running
- Mortar & Pestle

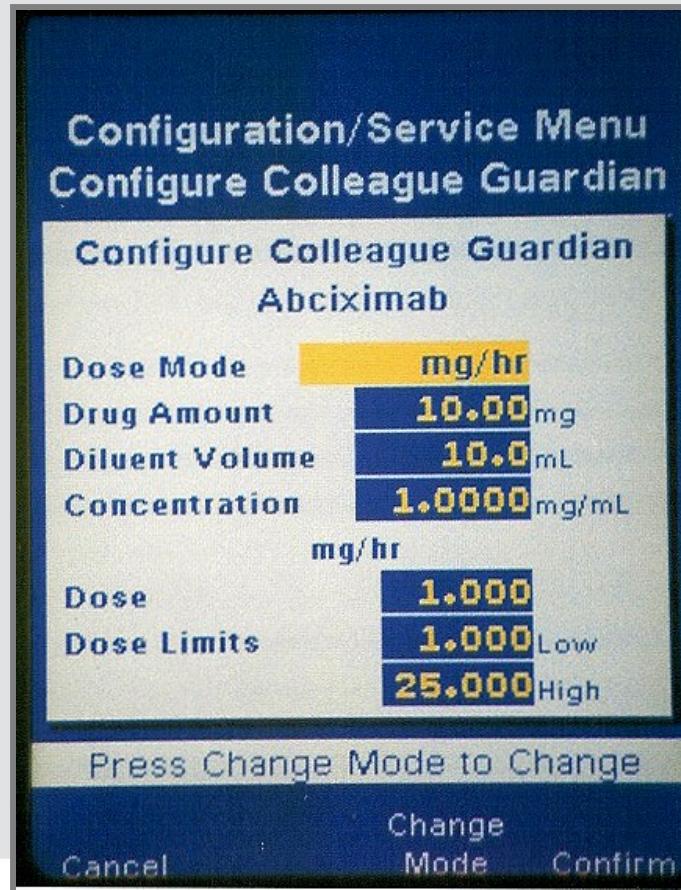


**Baxter**



# Guardian cont.

Drug selected  
and  
programmed  
in the service  
screens by  
authorized  
personnel

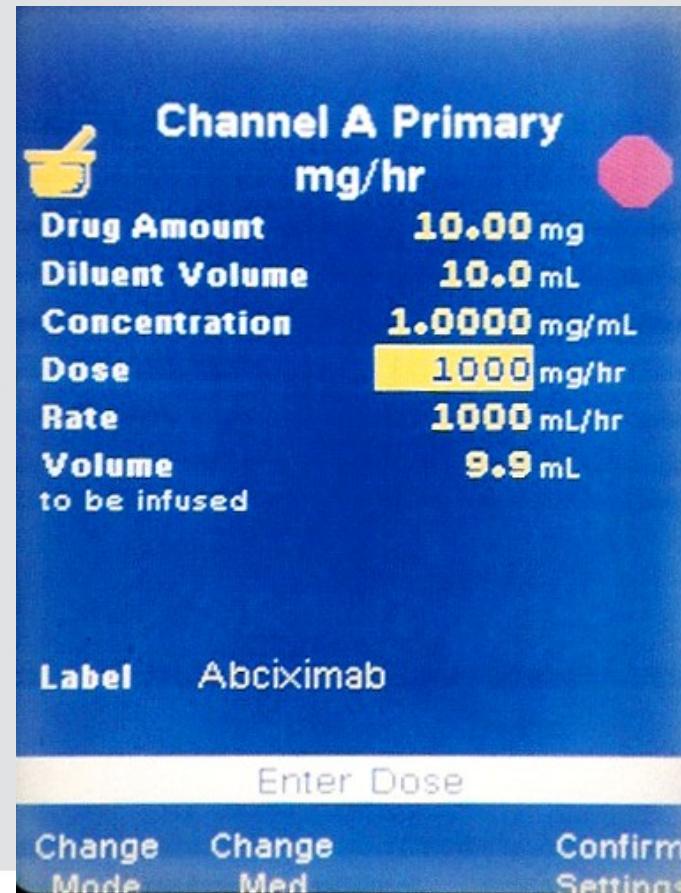


**Baxter**



# Guardian cont.

- Operator Programming
- Change mode
- Change med
- Units



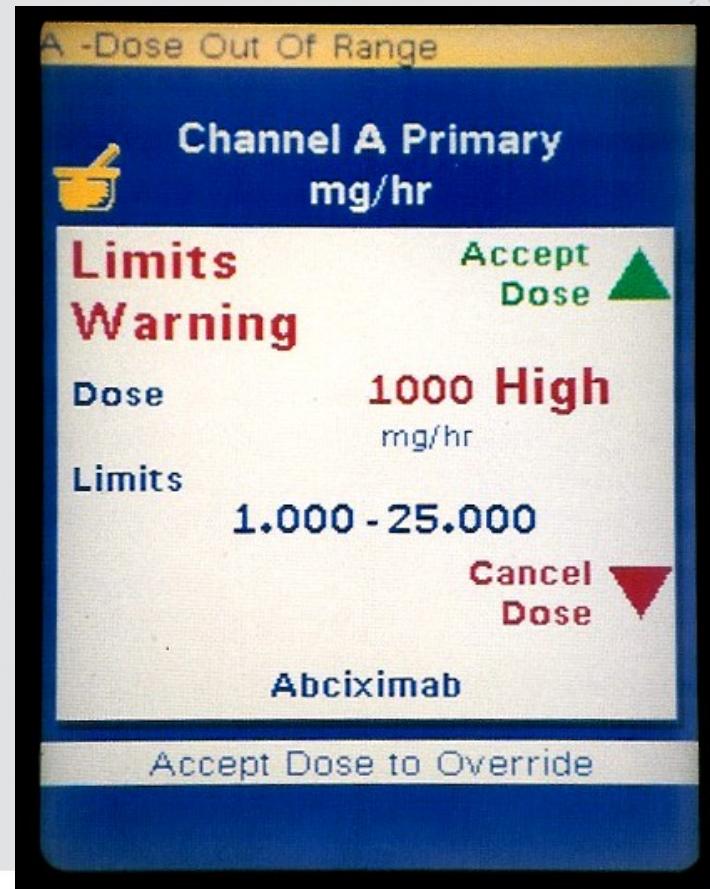
**Baxter**





# Guardian limit warning

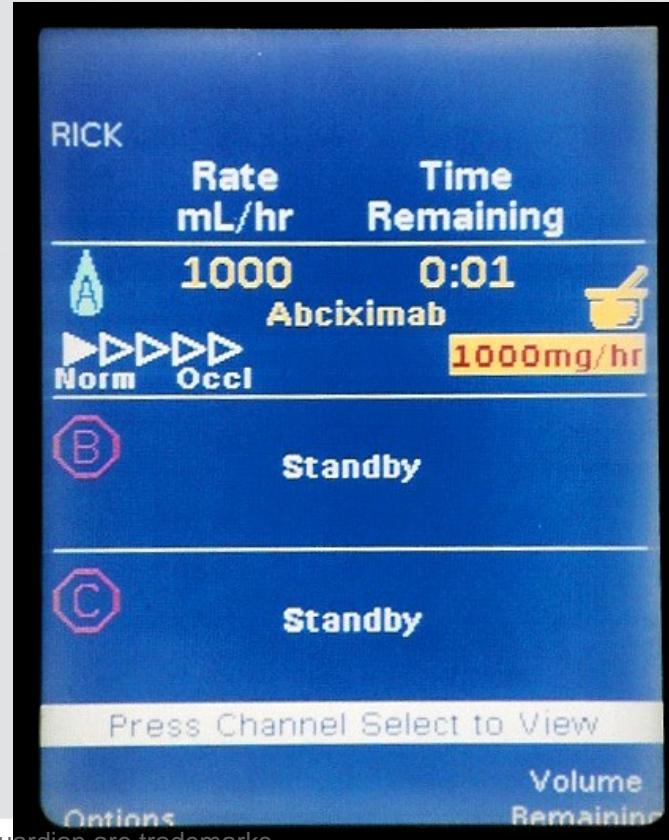
- Can be overridden





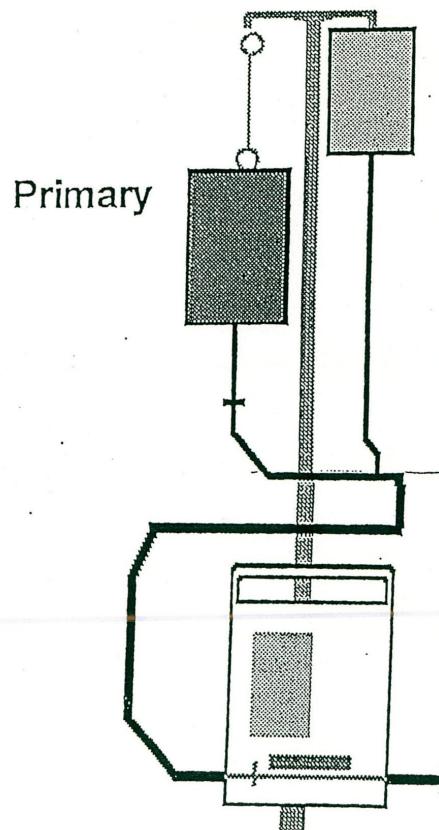
# Guardian cont.

- An infusion that has been overridden
- Limits are in yellow highlight



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RESPOND RESTORE RENEW



Piggyback  
(secondary)

Primary

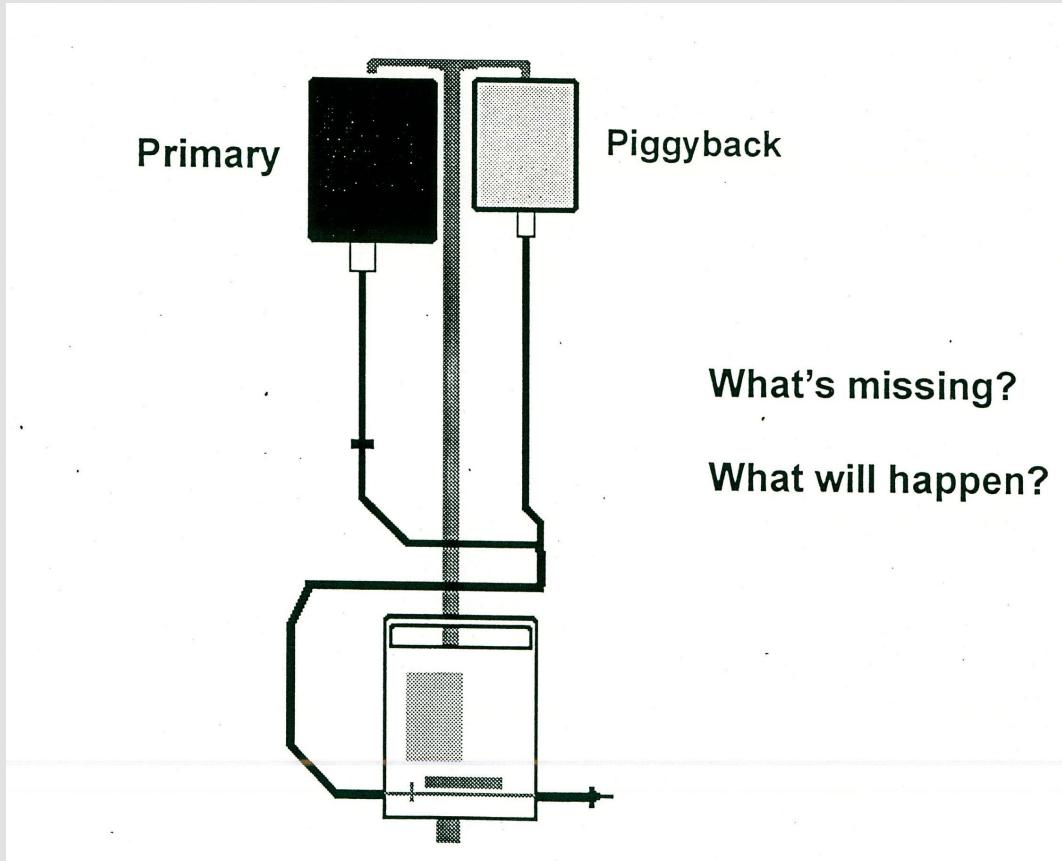
*3 Things to Remember,  
which bag:*

*is hung higher.  
is infused first.  
has a check valve.*

**Maximum Piggyback VTBI = 500ml/Hr**

**Baxter**

RESPOND RESTORE RENEW



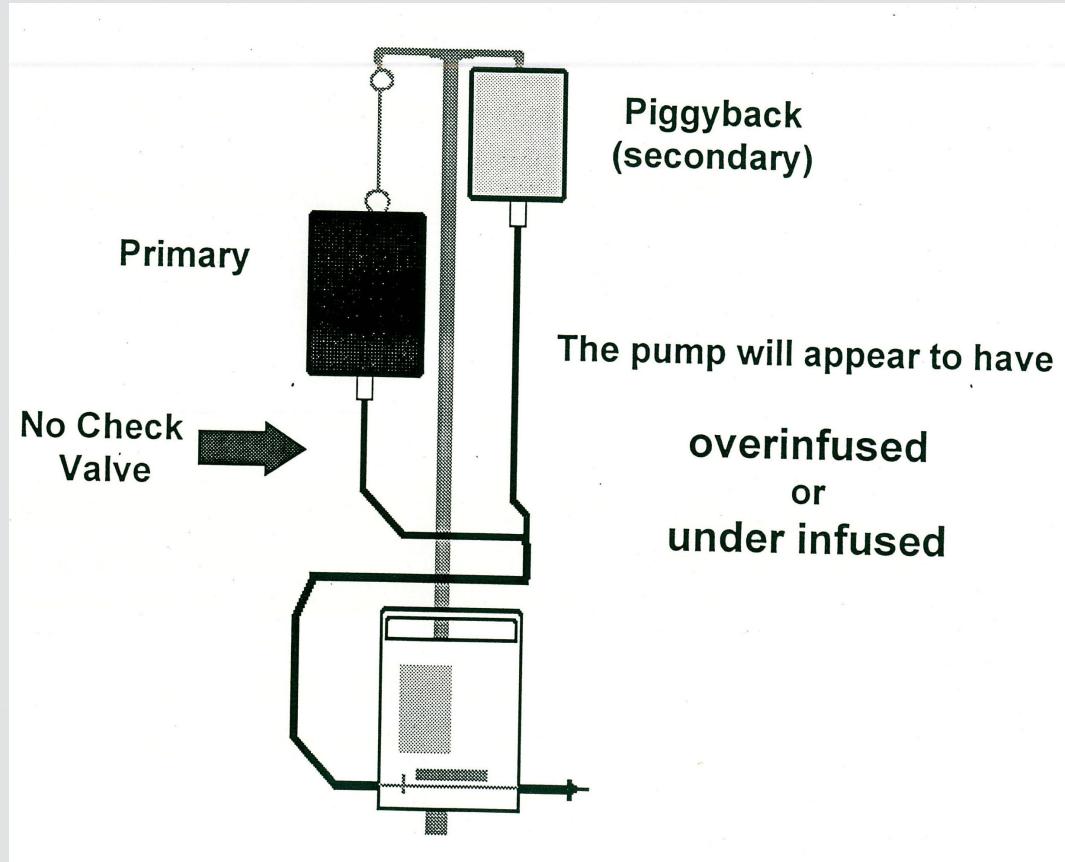
What's missing?

What will happen?



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RESPOND RESTORE RENEW

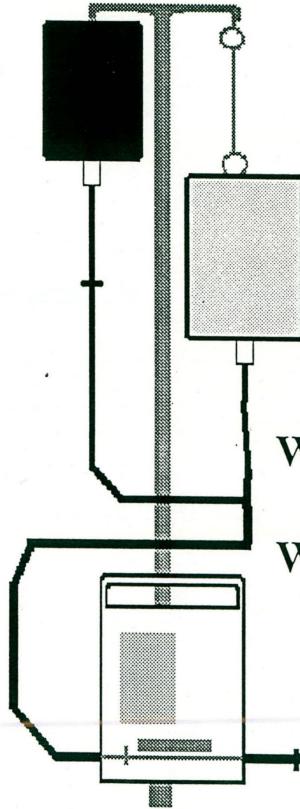


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RESPOND RESTORE RENEW



Primary



Piggyback  
(secondary)

What's wrong with this picture?

What will happen?

**Baxter**



# This is the End of the Colleague Technical Information Presentation

- Complete your Practical Session
- Do your Test
- Complete a Course feedback Questionnaire

RESPOND RESTORE RENEW



# Congratulations!

You have completed the Technical  
Training for the

## Colleague Infusion Device



**Baxter**